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Lubrication ENGINEERING

VOL. 6 FEBRUARY, 1950 NO. 1

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Northwestern Technological Institute, Evanston, Ill.

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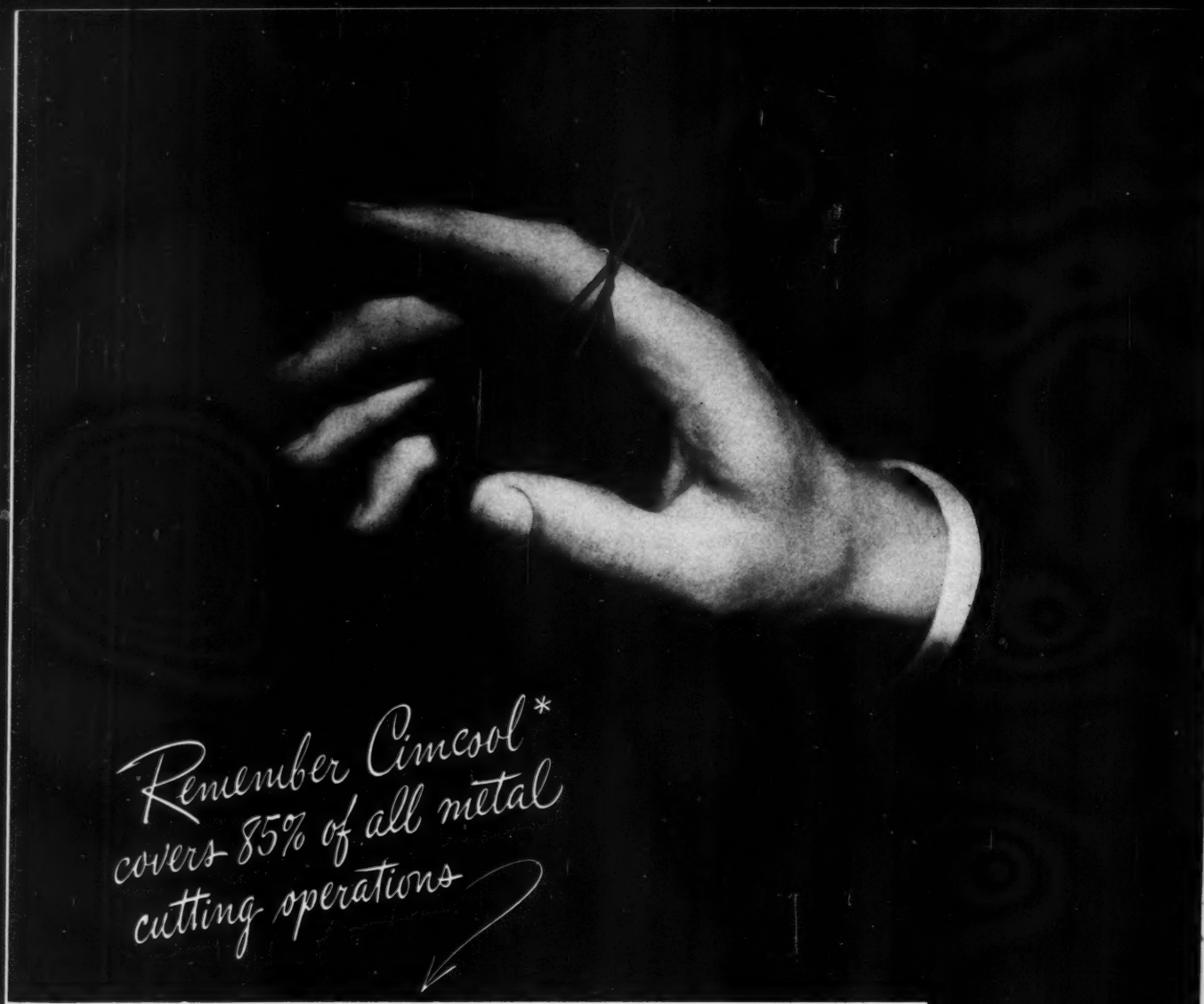

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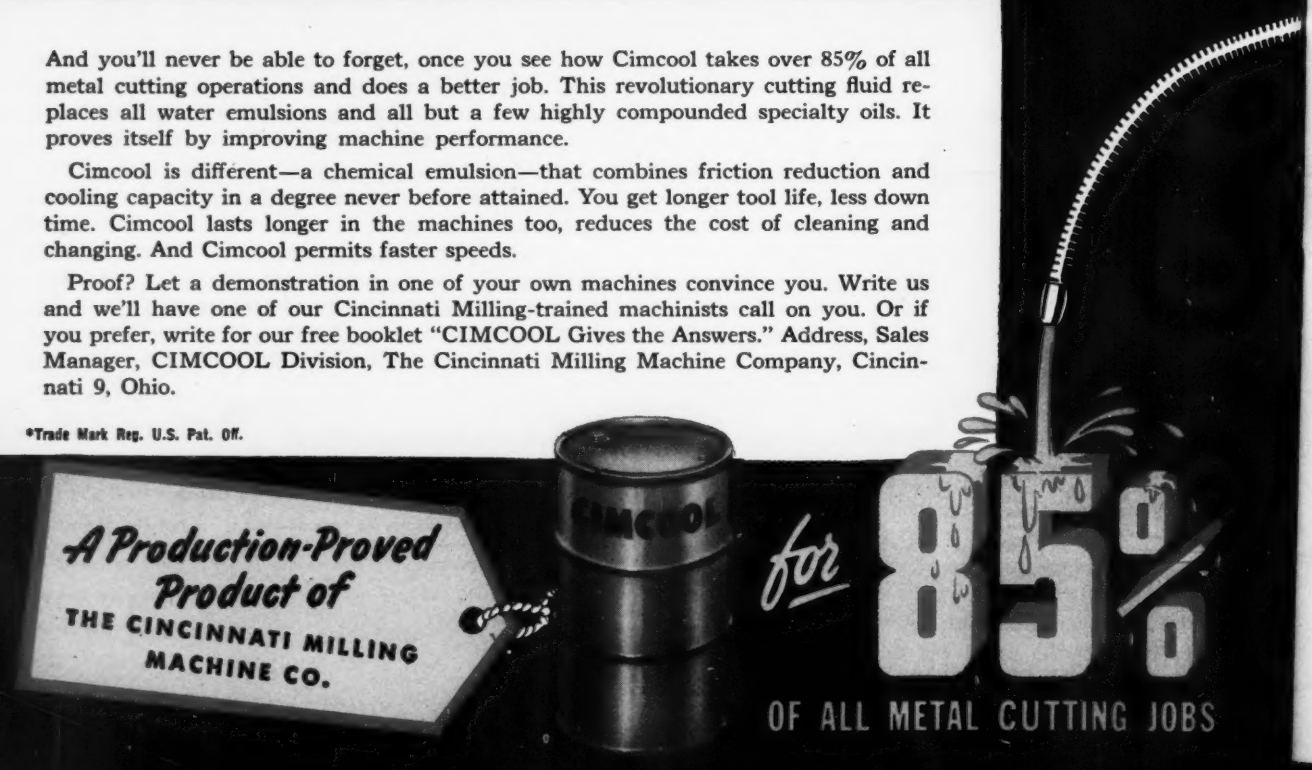

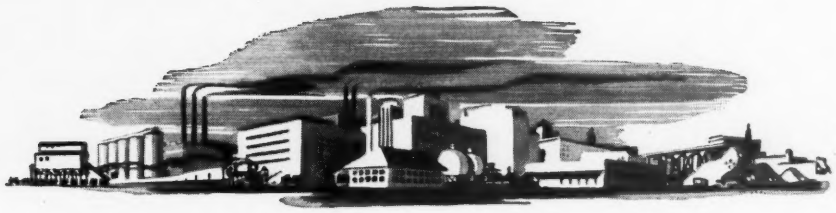

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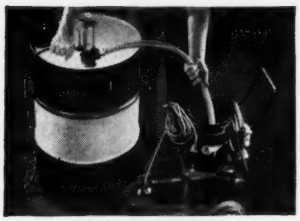

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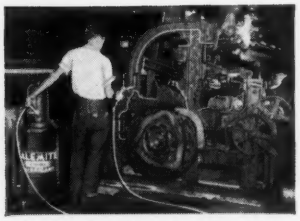

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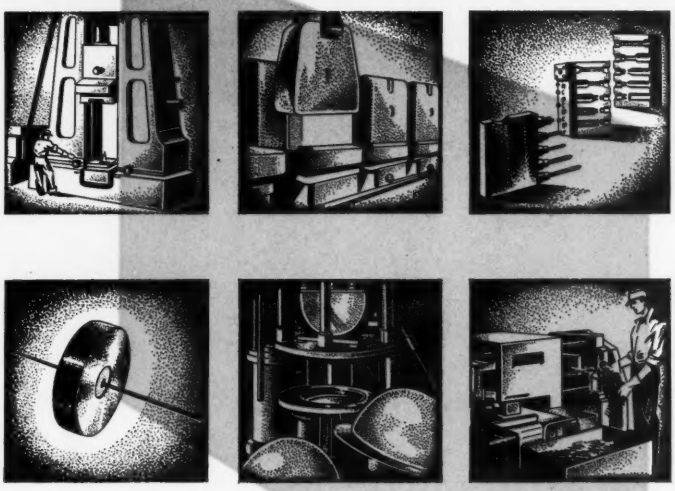

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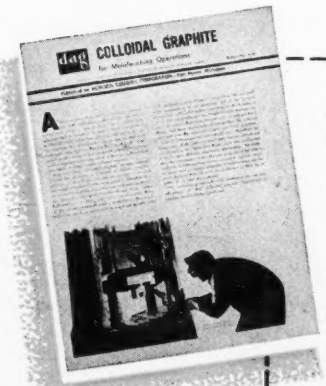

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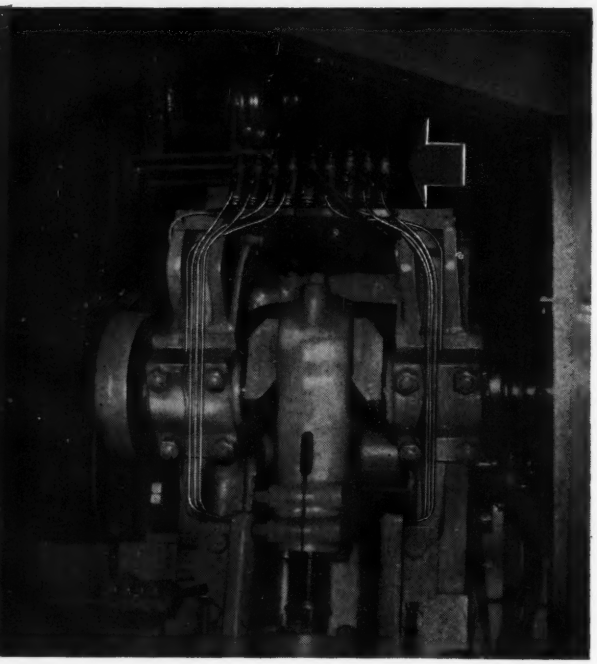

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THE EDITOR'S PAGE

Lubrication and Surfaces

The machine-tool industry for many years has been endeavoring to develop easy methods for making better surface finishes, in fact surfaces in which the maximum deviation is of the order of magnitude of 1 to 5 microinches. Surface developments have paid off exceptionally well; as for example, in honed cylinders where reduced wear has been noteworthy with high finishes. Paradoxically, however, in other instances, with supersmooth metal parts rubbing on each other, lubrication becomes unsatisfactory. This is particularly true with large flat surfaces. With these it is possible to get surfaces so perfect that the lubricant squeezes out completely and metal-to-metal rubbing takes place. Machine-tool builders are now taking cognizance of this fact, and many surface finishes are made in such a manner as to present definite scratch or cross-hatch patterns. These can retain lubricant in the minute metal valleys which feeds out as needed. Super finishes for positive-pressure-feed bearings are of course still satisfactory unless there is possibility of oil pressure failure or frequent starting and stopping occurs without full oil pressure available at the instant of starting.

Cold Pressure Welding

One of the most interesting developments to appear during the last year has been the recently announced development of a satisfactory method of cold welding of metals. This has been developed by the General Electric Company, Ltd., of England and has been successfully applied to several of the non-ferrous metals, in particular aluminum, duraluminum, lead, copper, zinc and silver. The importance of the process at present is largely associated with aluminum fabrication. In essence, the process is so simple as to make one wonder why it had not been developed previously. Apparently all that is necessary is to remove the oxide from the surface of the metal parts to be welded and bring the metal parts together under high unit pressure. When cleaning is completed and pressure applied the metals of the two surfaces actually flow into each other and make a tight and permanent bond at room temperature. No fluxes or chemicals are required and no filler metal is employed. In fact, it is stated that thin aluminum sheets, if properly cleaned, can be spot-welded with a pair of heavy pliers. It is well known that aluminum keeps its shiny appearance because of a protective oxide film which develops on the surface of the metal and prevents further corrosion. Apparently this can be removed by a vigorous wire brushing and does not re-form rapidly enough to prevent the application of cold welding to cleaned parts. In the fabrication of light parts and vessels, cold welding apparently holds real promise.

Research

Research is developing in ever-increasing importance as we pass the half-way mark of this century. Research is being carried out by industry itself, by research institutes and in colleges, and it is difficult to say in which category the percentage increase is being most rapid. An interesting review of current research in the colleges was recently published by the Engineering College Research Council of the American Society for Engineering Education. This review of current research is also a Directory of Member Institutions. The booklet, in its 186 pages, lists research being carried out in the 90 engineering college units comprising the Council. Actually, more than 4000 research projects are under active investigation with a total budget in excess of $35,000,000. Research in the industry probably exceeds this figure many-fold. Unfortunately, we do not know just how much research is being carried on, but we do know that in many companies from 1 to 20 per cent of the gross budget is devoted to research and development.

Airliner Propulsion

Indications are beginning to appear that the day of the reciprocating engine for driving big airliners is approaching its end. In particular, the work of the British in developing high-speed gas-turbine jet airliners is noteworthy. In this respect some people believe that the British are many years ahead of this country and may be in a position to take air supremacy away from us. Time alone will tell whether this is true, but this country has fortunately now begun to realize fully the importance of gas-turbine propulsion with its important variations—the turbo-jet and turbo-prop. Whereas reciprocating engine units with reasonable weight-power ratios may reach some 3000 hp, this appears to represent an almost top figure. For gas-turbine units the powers possible in a unit can easily run to two or three times this figure.

Mercury

At a recent meeting of ASME, a paper was delivered by Lucian A. Sheldon entitled "The Thermodynamic Properties of Mercury Vapor." At first glance such a paper appears to have little import to the general engineering public, but apparently this is not the case. Not many years ago, the steam plant was the only successful type of large central station. This is no longer the case, as an ever-increasing number of plants in which mercury and mercury-water are the working mediums are coming into use. Mercury as a heat-transfer agent in the refining of lubricants and other petroleum products has been in use for many years. Mercury, in all of these connections, owes its importance to the fact that it vaporizes or condenses with the development of high temperatures at relatively low pressures. Mercury, at a temperature of 907 F, for example, exerts a pressure of only 100 psi. In contrast to this, water-steam reaches its critical temperature at 705 F at a pressure of 3206 psi. Although mercury is difficult to handle and its vapors are toxic, it appears that we will see more and more of it used in industrial applications.

B. H. JENNINGS.

convention preview

Program plans for the Fifth Annual A.S.L.E. Convention to be held at the Hotel Statler, Detroit, Michigan, April 10-11-12, 1950, are nearing completion. The Society has been fortunate in securing an extremely interesting group of technical and practical papers for presentation before the Convention. The subjects to be covered will be of vital interest to lubrication, maintenance, petroleum, and research engineers. Although exact titles have not as yet been finalized, a tentative list of general subjects to be discussed, is presented below. Titles and authors are subject to change and additional papers will be added to round out the three-day agenda. A complete and detailed program will be published in the April issue of LUBRICATION ENGINEERING. It is hoped that this advance listing will serve to indicate the scope of subjects to be covered. Attendance at the Convention is a "must" for lubrication men.

PLANT LUBRICATION ENGINEERING PRACTICE

(Open forum conducted by Mr. L. A. Danse, Supervisor Materials and Processes, Production Engineering Section, General Motors Corp., Detroit, Mich.)

OIL RECLAMATION — SYMPOSIUM

(Various aspects of this controversial subject will be discussed by industrial representatives as well as oil suppliers.)

BEARINGS

SLEEVE BEARINGS — MECHANISM OF SLEEVE BEARING FAILURE

C. M. Allen and R. W. Dayton
Battelle Memorial Institute
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ROLLING MILL BEARINGS — LOADS AND OPERATING TEMPERATURES

J. H. Hitchcock
Director of Research
Morgan Construction Co.
Worcester, Mass.

ROLLING CONTACT BEARINGS — OPERATING CHARACTERISTICS AT HIGH SPEEDS

E. F. Macks and Z. Nemeth
National Advisory Committee for Aeronautics
Cleveland, Ohio

MEASUREMENT OF BEARING TEMPERATURES AND LOADS

H. H. Gillespie
Head of Bearings Division
Bureau of Ships, U. S. Navy and
L. Smith
U. S. Naval Engrg. Experiment Station
Annapolis, Md.

DRY LUBRICANTS

FRICTION OF BEARING MATERIALS CONTAINING MOLYBDENUM DISULPHIDE

R. L. Johnson, M. A. Swikert and E. E. Bisson
National Advisory Committee for Aeronautics
Cleveland, Ohio

MULTI-PURPOSE LUBRICANTS

E. M. Kipp
Aluminum Co. of America
New Kensington, Pa.

(This paper will discuss possible means of reducing the confusingly large number of lubricants used in industrial plants.)

LUBRICATION

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M. B. Roosa
Parker Rust Proof Co.
Detroit, Mich.

FRETTING CORROSION

(Friction Oxidation)

We are indebted to Dr. William H. Millett, Research Chemist of Linde Air Products Company, and Chairman of the National Program Committee, A.S.L.E., for enabling us to bring to our readers' attention this Convention preview. This was made possible through Dr. Millett's special trip to the National offices the early part of January.

Mr. Wiberley received a B.S. Degree in Chemistry from Rensselaer Polytechnic Institute in 1938. A year after his graduation he was engaged by Röhm & Haas Company of Bristol, Pennsylvania, as Assistant Microchemist. In April, 1946, he assumed a position as Microchemist in Socony-Vacuum Laboratories, Technical Service Department, Brooklyn, New York. At the present time Mr. Wiberley is a Research Associate in charge of the Microchemical Laboratory. He has been involved in the development of a large number of petroleum tests on a reduced scale. He is a member of the American Chemical Society and active in the affairs of the Metropolitan Microchemical Society of New York.

Mr. Rather received the Degree of B.S. in Chemical Engineering from Lehigh University in 1932. For the past five years he has been Assistant Director of the Technical Service Department of Socony-Vacuum Laboratories, with direct supervision of the Inspection Division. He is active in the work and affairs of the American Petroleum Institute, A.S.T.M. and A.C.S. Mr. Rather is Chairman of the API Committee on Analytical Research and of various A.S.T.M. subcommittees. He is author or co-author of a variety of papers concerned with the application, development and interpretation of test methods for petroleum products.

J. S. WIBERLEY

JAMES B. RATHER, JR.

TRACING CAUSES OF SLUDGES AND DEPOSITS IN LUBRICATING SYSTEMS BY USE OF MODERN MICROCHEMICAL METHODS*

ABSTRACT

Microchemical techniques are of great value in the analysis of small samples of sludges and deposits taken from lubricating systems. Both qualitative and quantitative inorganic and organic micromethods are adaptable to this problem. A general microchemical approach is suggested involving microscopic examination, determination of ash, determination of solubilities in petroleum ether and chloroform and qualitative organic analysis. The common causes of deposit formation and the interpretation of analytical results are briefly discussed. Some actual case histories are described where microchemistry made possible both identification of the material and the subsequent explanation as to its presence in the lubricating system.

by J. S. Wiberley
and
J. B. Rather, Jr.

Socony-Vacuum Laboratories
Technical Service Department
Brooklyn, New York

Introduction

Petroleum laboratories frequently have occasion to analyze samples of sludges and deposits taken from various parts of lubrication systems of engines and other equipment. When such analyses are interpreted correctly, it often is possible to solve difficult lubrication problems.

In many instances, the quantity of the material which must be analyzed is extremely small. For example, it may consist of only a few milligrams of substance removed from a bearing, a piston or an oil cooler. Despite the smallness of the sample, it may be essential to perform a detailed analysis. On the basis of accurate compositional information and a knowledge of the system, it is possible to draw conclusions concerning the cause for the formation of the deposit. Where such samples are encountered, micro-methods are valuable and often indispensable.

There are a great many kinds of sludges and deposits and they are seldom alike. Depending upon the particular environmental conditions, external contaminants of a widely varying nature may be found. Often the identification of this foreign material solves the problem. Certain of the components may originate in the lubricating system as a result of deterioration of the oil, from corrosion or from wear. Sometimes the conditions which cause the sludge to form are of a mechanical or operational nature and can be corrected. The analysis may provide the necessary information to make the correction.

Consumers are apt to form the opinion that the presence of a deposit is in itself an indication of poor quality of the oil. Actual experience in the examination of numerous samples of a wide variety of substance taken from lubricating systems has shown that generally the oil is not basically responsible. At times, microchemistry offers the only means for proving this fact.

Naturally, there is no complete scheme of microanalysis for all sludges and deposits. The extent of the analysis in each instance will depend upon the problem involved, and much discretion must be left to the microchemist who is handling the sample. Obviously, it is beyond the scope of this paper to present the fine points of the different procedures. The authors, however, wish to review the general microchemical approach which is followed by Socony-Vacuum Laboratories, Technical Service Department.

Microscopic Qualitative Examination

The first step is examination under a stereoscopic microscope at 10 diameters magnification. This reveals the color, texture and homogeneity of the sample. By picking over the material with a glass rod or tweezers, specific particles may be examined and isolated for

* Presented orally at a Joint Symposium on Microchemistry in the Petroleum Industry sponsored by several divisions of the American Chemical Society in San Francisco, California, March 27 to April 1, 1949.

separate tests. Metallic particles, corrosion products, fibers and many kinds of foreign material are thus recognized. A small magnet is indispensable for testing metallic particles. Parts of the sample may be tested for solubility in water, acids, chloroform or other solvent on the microscope slide or in a one-milliliter centrifuge cone and the solution may be subjected to other tests. Solutions of metals are easily and quickly tested for iron, copper and zinc by means of potassium mercuric thiocyanate reagent and for lead with potassium iodide. A portion of the sample may be ignited in platinum. Qualitative indications concerning composition are thus obtained by noting the nature of the flame and the odor of the fumes. The character of the ash is studied by inspection under the microscope. In short, any of the conventional microchemical tests which suggest themselves on visual inspection or because of the past history of the sample are used (4, 6, 8, 10, 24).

The chemical microscope with magnifications of 100 to 200 diameters is used to study carefully finer structures such as fibers, mineral grains and abrasives. Other routine tests for certain types of material are the addition of dyes to differentiate textile (7) and paper fibers (28), refractive index measurements, and observation of the appearance under polarized light (16). The crystals resulting from chemical tests on the microscope slide are generally observed and identified at the above mentioned magnification.

Microscopic examination takes little time and, in most cases, furnishes a good knowledge of the sample not obtainable in any other way.

Ash

Since the deposits are likely to be mixtures of organic, metallo-organic and inorganic materials, a quantitative determination of the ash content is generally performed. This is usually accomplished by igniting a sample of from 1 to 50 milligrams in a 00000 porcelain crucible at about 700°C in an electric muffle furnace. In addition to organic matter, water and other volatile substances are lost so that no very rigid interpretation can be attached to the value obtained. Nevertheless, it is a convenient indication of the presence of inorganic elements. In some cases, this ash is tested by micro qualitative slide and spot tests for the common elements, but usually it is analyzed spectroscopically.

Once the metals in the sample have been identified, a scheme of quantitative analysis may be devised, if that seems necessary. Any macro system of gravimetric, volumetric or colorimetric methods may be scaled down to suit the purpose. The centrifuge cone, which is described in the section on solubility, the filter tube (21, 23), and the filter stick (9, 22) are useful in gravimetric determinations and in separations. For volumetric analysis, the customary 10-ml buret or a capillary buret such as those described by Kirk (14) or Scholander (13) may be used depending upon the strength of the standard solutions. For the purpose of micro colorimetry, small cells are available for visual as well as photoelectric colorimeters and spectrophotometers (15). Since the amount of sample is generally small and sensitivity often more important than accuracy, micro colorimetric analysis is most frequently of use. Where a polarograph is available, good sensitivity with adequate accuracy can be obtained. The latter has the added advantage that the solution can be recovered for other determinations.

Solubility

Normally, petroleum lubricants oxidize slowly in use, the rate depending on the stability of the base oil, the amount and nature of antioxidants present and the conditions of use. Some of these oxidation products may become insoluble in the oil through polymerization or, being acidic, may react with metals to form soaps which are insoluble. These products, while insoluble in oil and petroleum ether, are usually soluble in chloroform. Further oxidation and polymerization, especially at higher temperatures, may produce so-called carbonaceous materials which pass this stage of solubility and which are insoluble in organic solvents generally. Separation by solubility is certainly an over simplification but it provides a rapid, useful test.

The solubility of small deposits in petroleum ether and chloroform is quantitatively determined in a glass centrifuge cone equipped with a glass stirring rod. A sample of from 1 to 100 milligrams is weighed into the cone together with the stirrer. Solvent is added and removed by means of a syringe pipet. The solvent is added and mixed with the sample using the stirring rod. The rod is removed and the cone is centrifuged. The clear supernatent solvent is transferred to a small beaker. More solvent is added and the sample is extracted two to six additional times until the supernatent solvent is colorless and free from dissolved material. After careful drying, the residue is weighed in the cone and the amount soluble is calculated (29).

Occasionally, samples contain very fine matter which refuses to collect in the point of the cone but remains suspended in the solvent. Sometimes "tricks" such as the addition of a little alcohol or evaporation of the suspension liquid and redissolving of the soluble matter will help. If the extract remains cloudy, the presence of suspended matter may be confirmed by taking the suspension to dryness and observing the residue under the microscope. Suspended material appears as discrete specks whereas dissolved substance precipitates in continuous rings. The suspended material may be identified by suitable tests and proper allowance for its presence in the soluble part can be made in the interpretation of the results.

It is often necessary to subject the recovered fractions to further qualitative and quantitative tests. The residue of the petroleum ether extract is inspected to make certain that it actually is nothing but the original lubricant. It may be advisable to obtain the specific gravity by weighing a known volume of the oil in a capillary pycnometer, or to determine the viscosity by timing the flow through a calibrated viscometer tube. Both values are easily obtained on volumes of 0.1 ml, and special techniques permit the handling of smaller samples (1, 17). A neutralization number which is obtained by a procedure similar to the ASTM Method (2) can be determined on 0.1 gram of oil. A 25 or 50 ml Erlenmeyer flask, a 10ml microburet and 0.01 N solutions are required. The amount of solvent is decreased proportionally or nearly so, but the heating and titrating conditions are kept close to ASTM recommendations. In a similar manner, a saponification number on the oil may be obtained following the ASTM Method (3) with quantities of reagent reduced by an amount dictated by the size of the sample.

The chloroform soluble material may be tested for metallic soaps by ashing and qualitative analysis of the residue followed possibly by the quantitative determination of some of the constituents. Oxidized oil may be indicated by appearance, odor on heating, and the determination of neutralization and saponfication numbers. Other organic materials may be examined in accordance with the suggestions for qualitative organic analysis which follow.

The chloroform insoluble material is nearly always given a separate microscopic examination whereby the same procedure is followed as in the inspection of the original sample. If the material appears crystalline, like the metals and corrosion products so frequently found, x-ray diffraction analysis is frequently employed to furnish identification or confirmation of the specific compounds present. If the material is amorphous and probably organic, it may be treated as an organic unknown. Incidentally, carbonaceous materials may actually contain very little free carbon and substantial amounts of acidic oxidized material may be extracted by treatment with acid to break up insoluble soaps followed by saponification with alkali.

Qualitative Organic Analysis

The inorganic side of the analysis is generally straightforward and a high proportion of sludges and deposits have some such material present. On the organic side, however, a different situation exists. The sample may contain complex products derived from the oxidation of the oil. Since contamination is always a possibility, the sample may also contain any kind and number of more or less altered technical materials such as rubber, grease, leather, paint and cork. These commonly used materials are not well defined compounds and it is not practical to isolate their pure components for the purpose of their identification. The qualitative procedures of Mulliken (20) are, therefore, seldom of use. The suggestions of Snell and Biffin in their chapter on "Preliminaries to the Analysis" are of more value (27). They discuss a number of very general tests which, when applied to any unknown sample, help to establish its primary classification.

There is additional difficulty, however, for these various technical materials are usually not preserved in the sample in their original state. As a rule, they have been pulverized and partly oxidized so that they have lost their most characteristic properties. It is very helpful, therefore, to ascertain, as far as possible, the materials known to be present or likely to be present in the system. If the lubricant is compounded, its composition is ascertained if possible. Past experience may indicate some probable reaction products of the original materials.

Contamination derived from the atmosphere consists ordinarily of lint, sand, and other dust, but there may be special dust in the locality where the lubricant was in use. Accidental contamination may be anticipated if, for example, there were containers of some other material nearby which might have been mistaken for the lubricant. When such information can be obtained in advance, the time for the analysis may be materially shortened. The sample then can be examined systematically with a view to proving the presence or absence of these suspected materials. Appearance alone will eliminate some. Qualitative and quantitative tests for certain elements, as nitrogen, sulfur, chlorine or phosphorus may indicate the presence of a material even though it has undergone some chemical change. Allowance is made for small percentages of common elements, since these are found in almost any deposit. It almost never occurs that a compound can be isolated in such a state of purity as to be worthy of a carbon and hydrogen determination. Furthermore, those deposits usually contain such a variety of elements in addition to carbon or hydrogen, that such an analysis on the mixture is worthless. Odors at room temperature and on ignition are often helpful. When heated, the smell of an "oxidized oil" is fairly characteristic. Contaminants like rubber, plastics, and proteins have their characteristic odors when burned. Since the deposit is saturated with oil, other odors may be masked unless most of the oil is first removed by a solvent. If a liquid other than oil is present, distillation and the determination of boiling point and density is indicated. Tests for acidic or basic properties, or a trial saponification may help in establishing the nature of the material. Oil and other organic substances which have undergone partial oxidation generally give high acid and saponification numbers. Isolated acids may be examined for appearance, melting point, iodine number or average molecular weight. Tests are also performed for organic functional groups and for a few specific compounds (11), if their presence is suspected.

For particular technical products there are specialized tests, such as for plastics (19, 25), rubber (5, 19), or paint (12, 18). Books on the analysis of technical materials (26) may have to be consulted before the most suitable tests can be selected. All of this fact gathering, however, must be accompanied and supported by experimental studies on known mixtures before any confidence may be placed on the findings with the unknown. The suitability of recommended tests must be proved, before their validity under the existing circumstances can be accepted. In general, an intimate familiarity with a wide variety of materials is of far greater help than any system of analysis which could ever be devised. As experience accumulates in working with small amounts of known and unknown mixtures, it becomes increasingly less difficult to select those tests which lead most directly to final identification.

Interpretation of Results

Analyses of sludges and deposits are made with the objective of developing information which permits arriving at an explanation for the presence of the material in the lubricating system. An excessively high percentage of oxidized oil may be indicative of the fact that the oil is being subjected to abnormally severe conditions of use. It may also reflect the fact that certain materials are present in the system which have exhibited a catalytic effect on oxidation or else that the product has been kept in service for too prolonged a period. Regardless of the cause, an investigation on the part of the operator of the equipment is warranted. An abnormally high percentage of ash may be caused by unusual wear, the presence of excessive rust or contamination from some outside source. In addition, metallic soaps formed by the action of products of oxidation with metal parts in the system, are reflected in the ash content. Obviously, it is impossible to set up any test limits for insolubles, ash content, water or any of the innumerable contaminants which would have consistent significance in interpreting the findings of a deposit analysis. Each sample generally represents a unique and individual problem and results must be judged on the basis of the circumstances involved.

Incidentally, it must be borne in mind that in most cases the quantity of the deposit is no more than an insignificant fraction of the quantity of lubricant in the system. Consequently, the deposit may be the result of the gradual accumulation of traces of impurities. This may not be suspected until revealed by the analysis.

Typical Analyses

Identification of Deposits Taken From Lubricating System Operating in Presence of Acid Fumes.

A number of small samples of black deposit taken from the oil circulation system of certain equipment

operated by a rayon manufacturer were analyzed. Since the system in question was close to spinning baths, the outside atmospheric conditions, being humid and acid, were extremely corrosive. It was suspected that these acid vapors had entered the system and had blackened and decomposed the lubricating oil. Only a limited amount of sample was available. The smallest of these samples was examined qualitatively. Solubilities in petroleum ether and chloroform were slight, indicating only minor amounts of oil and its products of oxidation and polymerization. The remainder was partly soluble in water and almost completely soluble in nitric acid. Slide tests for copper, iron, sulfates and sulfides were positive. The ash percentage was high, and qualitative micro tests indentified the major ash elements as copper and iron, with minors of lead, tin, silica and sodium. All the other deposits taken from the system gave similar evidence. The oil portion of the deposits showed no deterioration and was recovered as a light yellow product having the characteristics of new oil. The black material was found to consist of entirely inorganic sulfides and sulfates, i.e., of corrosion products of the metals of the lubricating system. By X-ray diffraction analysis, it was possible to identify in some of the deposits iron oxides, cuprous sulfide, iron metal, sodium sulfate and quartz.

As a consequence of the analyses, it became clear that the deposits had been caused by the action of moisture and acids on metal parts of the system and that the oil was not involved in the deposit formation. On the basis of this information, temporary cleaning measures and preventive suggestions were made.

Turbine Deposits

An investigation was made to determine the cause of the formation of deposits in the lubricating system of a large turbine. It was reported that these deposits made it necessary to frequently clean the oil cooler. As examples of this condition, several small samples taken from the oil reservoir and centrifuge were examined.

The results of the quantitative analysis of one of the samples is shown in Table I. The black pasty sludge was separated by centrifuging and filtering into oil, water, and sediment. The sediment was separated into two fractions by chloroform solubility. The chloroform soluble portion was a black solid appearing to be a mixed metallic soap of an oxidized oil. The metallic constituents were sufficiently identified by ash, spectroscopic, polarographic and colorimetric analyses. The organic acidic material was isolated by treatment with hydrochloric acid followed by potassium hydroxide. The potassium soaps were purified and precipitated as copper soaps. An ash determination on this copper soap made possible a calculation of approximate molecular weight. An average carbon content of about C_{25} was indicated, placing it in the lubricating oil range.

The major part of this sediment, however, was insoluble in chloroform. This was a rusty brown powder which consisted of iron and copper phosphates, rust, sand and a list of several mineral or metallic minor elements. The finding of large amounts of phosphates was unexpected and yet typical of such problems. The coolers were being cleaned with a highly alkaline phosphate solution and the cleaning operation itself was responsible for most of this sediment. Taken as a whole, the sediment, which was the emulsifier and cause of the sludge, consisted of approximately one-sixth oxidized oil soaps coming from old deposits in the system, and five-sixths inorganic phosphates, rust and dirt. In later samples the soaps decreased and the phosphates disappeared altogether when the use of that cleansing solution was discontinued.

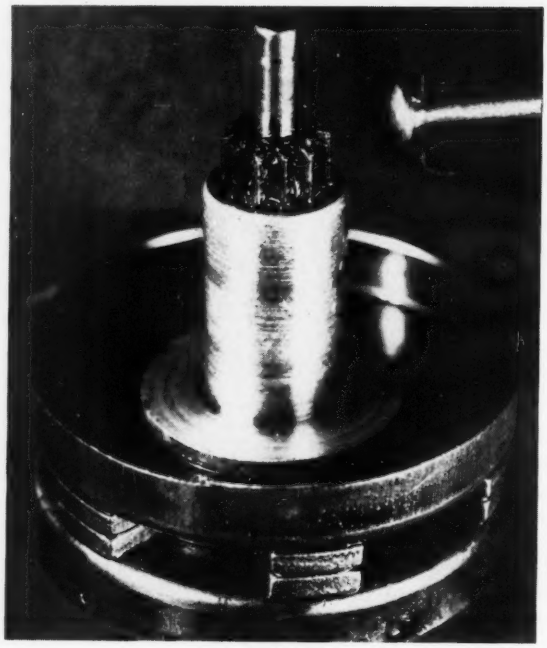

Fig. 1
Deposit on clock gear pin head included for size comparison.

TABLE I

TURBINE OIL DEPOSIT

Analysis of Sludge	
% Oil	17.2
% Water	0.1
% Sediment	82.7
Analysis of Sediment	
% Soluble in Chloroform	16.1
% Insoluble in Chloroform	83.9
Analysis of Chloroform Soluble Sediment	
% Ash	7.9
In Ash (Spectroscopic):	
Major	Copper, Iron
Minor	Lead, Zinc, Phosphorus
In Ash (Micro Quantitative):	
% Copper as CuO	63.8
% Iron as Fe_2O_3	13.0
% Lead as PbO	13.5
% Zinc as ZnO	4.3
Analysis of Chloroform Insoluble Sediment	
% Ash	68.3
In Ash (Spectroscopic):	
Major	Iron, Copper, Phosphorus
Minor	Lead, Sodium, Aluminum Calcium, Magnesium, Silicon, Tin, Zinc.
In Ash (Micro Quantitative):	
% Iron as Fe_2O_3	14.6
% Copper as CuO	12.1
% Phosphorus as PO_4	61.7

Deposits Formed in Electric Clock Motors

Several electric clock motors, which had stopped after only a few months service, were examined to determine the cause of the trouble. When parts were observed under a low power microscope, a gummy

brown deposit was observed on the metal pivots and a green jelly-like deposit was found on various brass parts as shown in Fig. 1. It had been suggested by the manufacturer that soldering flux might be involved. A list of possible materials within the system was made which included the following: oxidized mineral or fatty oil or their soaps, rosin or zinc chloride soldering flux, glyptal sealing compound, phenolite gear material, varnish from insulation paper on the coils, and enamel on the coil wire.

A 9 milligram sample of the brown deposit was tested for solubility.

Soluble in Petroleum Ether	44.8%
Soluble in Chloroform	45.6%
Soluble in Hydrochloric Acid	9.2%
Insoluble	0.4%

A 5 milligram sample was ignited.

Ash	8.2%

The oil portion of the deposit was dissolved in petroleum ether and qualitative saponification indicated that it contained a fatty oil.

The chloroform solubles showed the following characteristics: An acid extract gave a strong test for iron. Liebermann-Storch and chloride tests were negative, eliminating the solder flux. Microscopic comparison and solubility tests further eliminated glyptal, phenolite, varnish and enamel. The material in appearance resembled an iron soap. Isolation of the acid, a yellowish liquid, yielded less than milligram quantities. A qualitative test for unsaturated compounds was obtained by adding a drop of bromide in carbon tetrachloride to a speck of the soap on a cavity slide. After allowing the slide to stand covered for five minutes, a drop of fluorescein in alcohol was added and the mixture was made alkaline. Free bromine reacts to form pink eosin whereas, if all the bromine is absorbed by the unsaturates, the orange color of fluorescein remains unchanged. The amounts of reagents were adjusted and the test confirmed by trial on known samples. The soap under examination gave a positive test for unsaturated compounds.

The chloroform insoluble material was identified as iron rust with a few free iron particles.

The green deposit was similarly analyzed and found to be a soap of copper and zinc with an unsaturated acid.

Thus, the sum of the evidence pointed to formation of metal soaps as a result of reaction of free unsaturated fatty acid in the lubricant with the metal parts.

Conclusions

In conclusion the authors wish to state that, while the industry has been slow in making a serious study of the various possible applications of micromethods, little doubt now remains as to the overall value of a well equipped microchemical laboratory. In this paper it has been emphasized that such methods are invaluable in the investigation of the nature and causes of sludges and deposits formed in lubricating systems.

Acknowledgment

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NACA FRICTION STUDIES OF LUBRICATION AT HIGH SLIDING VELOCITIES*

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Mr. Johnson graduated from Montana State College in 1942 with a Bachelor of Science degree in Mechanical Engineering and was then employed by the National Advisory Committee for Aeronautics at Langley Memorial Aeronautical Laboratory. In 1943, he was transferred to NACA Cleveland Laboratory. His work has included fundamental and applied research relative to lubrication of aircraft propulsion systems; at present he is in charge of the Sliding Friction Research conducted by the Lubrication, Friction and Wear Research Section of the NACA Laboratory

Summary

Kinetic friction experiments were conducted on steel specimens with various lubricant films over a range of sliding velocities between 50 and 8000 feet per minute and loads from 269 to 1,543 grams (126,000 to 225,000 pounds per square inch, initial Hertz surface stress).

The lubricant film types of this investigation included: (1) solid surface films, (2) supplemental lubricants, and (3) lubricants containing extreme-pressure or anti-weld agents. Among the solid surface films were the various iron oxides such as ferroso-ferric oxide Fe_3O_4 and ferric oxide α–Fe_2O_3. The supplemental lubricant films included molybdenum disulfide MoS_2 and graphite and the extreme-pressure additive agent was free sulfur.

It was determined that a film of Fe_3O_4 was beneficial with respect to friction and wear. On the other hand, a film of Fe_2O_3 was not generally beneficial with respect to friction and wear over the entire range of sliding velocities. Molybdenum disulfide was very effective in reducing friction at high sliding velocities. This film material was very tenacious, was chemically and thermally stable, and consequently indicated possibilities for use as a supplemental lubricant under extreme operating conditions.

Analytical consideration of lubrication with extreme pressure additives at high sliding velocities suggested the hypothesis that rate of chemical reaction between surface and additive agents is a limiting factor. In support of this hypothesis, experimental evidence was found indicating lubrication failures at high sliding velocities for solutions of sulfur in cetane. Above a critical velocity friction showed a definite increasing trend and mass surface welding occurred. Variations in load and in sulfur concentration had no appreciable effect on the sliding velocity at which lubricant failure occurred.

Introduction

The need for research on friction of lubricant films at high sliding velocities may be best indicated by a brief review of the problems encountered in aircraft-propulsion units. These problems are prevalent in the operation of gas-turbine engines and they can be associated with the high speeds and extreme temperatures that occur in high-speed bearings, sliding seals and reduction gearing.

Fortunately, from a research standpoint the specific problems can be broken down to permit fundamental studies of their basic factors. These basic factors are:

(a) pure sliding,
(b) sliding and rolling,
(c) pure rolling, and
(d) high-temperature surface fatigue.

Research on these basic factors should provide fundamental information which can be then applied to the solution of many practical problems.

At the very beginning of any consideration of the lubricant problems it is immediately apparent that some sort of compromise must be reached in selecting a lubricant for a specific application. This situation arises because of the fact that there will be such a wide varia-

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tion in ambient temperature from sea level to high altitudes and the different ambient temperatures result in different lubrication requirements. At sea level, for example, a turbine type engine under takeoff conditions in aircraft will be operating under high temperature limits. At these high temperatures a need is indicated for addition agents to provide the required load-carrying capacity and anti-weld properties. On the other hand, conditions of flight at high altitudes and of starting at low temperatures indicate a need for low-viscosity lubricants. These contradictory requirements must be compromised.

All of these problems indicate the need for extensive research to provide the basic information required for their solution. The purpose of this paper is to present some of this basic information in the field of sliding friction. The data reported herein were obtained at the NACA's Cleveland laboratory and are reported in more detail in references 1, 2, and 3.

Apparatus and Procedure

Friction apparatus.—The experimental friction studies were conducted at NACA with equipment that is essentially the same as that of the Deeley-Herchel type. This equipment and its use are described in detail in reference 1. Figure 1 is a schematic diagram showing the basic elements of the equipment. In essence, it consists of a rotating disk on which slides a spherical rider. This rider is elastically restrained so as to permit the measurement of the friction force while the load is applied along the axis of the rider holder as indicated. A motor driven radial-feed mechanism, calibrated to indicate radial position of the rider, causes the rider to traverse a spiral path on the rotating disk so that no overlapping of the wear tracks occurs.

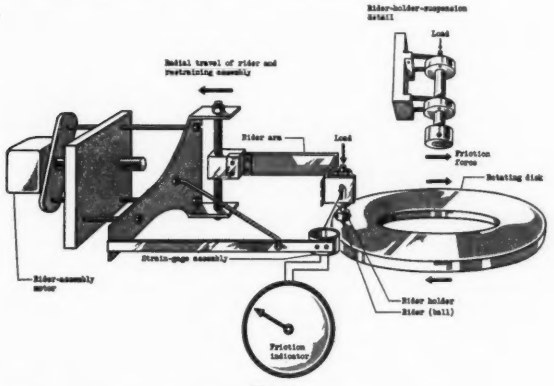

Fig. 1

Schematic diagram of sliding friction apparatus.

The physical and chemical conditions of the surface and sub-surface materials of the research specimens were studied before and after the sliding friction experiments by means of surface-roughness and surface-hardness measurements, X-ray and electron diffraction, and metallographic examination.

Specimen preparation.—In all experiments reported herein both the disk and the ball specimens were steel. The disk specimens were of normalized SAE 1020 steel with a hardness of Rockwell A-50. The rider specimens were commercial grade SAE 1095 steel balls, ¼ inch in diameter, hardened to Rockwell C-60. Careful preparation of the specimens was found to be the most important single requirement for consistent results of the experiments. The procedure used in cleaning the disk specimens was developed from that used in reference 4. The cleaning procedure removed all traces of grease, moisture, and oxides, down to an invisible film of ferroso-ferric oxide Fe_3O_4, which is shown in reference 5 to be approximately 15 to 25 Angstrom units thick.

The experimental investigation was made at loads of 269 to 1543 grams (126,000 to 225,000 pounds per square inch, initial Hertz surface stress), and over a range of sliding velocities between 50 and 8000 feet per minute. In all cases clean dry air was forced over the friction specimens prior to and during the experiment to eliminate moisture effects and to prevent possible contamination from room atmosphere.

Results and Discussion

Friction at high sliding velocities.—Figure 2 shows the effect of sliding velocity on coefficient of kinetic friction for dry and for boundary lubricated surfaces. As indicated, for dry steel at all three loads, friction coefficient is essentially constant at sliding velocities below approximately 1800 feet per minute, above which a decreasing trend can be observed for an increase in sliding velocity. No effect of change in load can be observed. The curve for lubricated steels shows a continuous decreasing with increase in sliding velocity throughout the entire speed range investigated. Again, no effect of change in load can be observed. The lubricant was oleic acid applied in a very thin film to the disk specimen and the conditions were obviously those of boundary lubrication at these loads. The same curve was also attained using a commercial SAE 10 oil as the lubricant.

Oxides.—Several research investigations at the NACA and other laboratories have indicated that the effect of oxides on friction and wear of sliding surfaces are appreciable. In many cases disagreements and contradictions have been reported as to the effects of the oxides. This situation indicated the need for a research investigation which would resolve the roles of the specific oxides.

In an investigation at NACA, reported in reference 1, results were obtained that showed the friction of steel on steel as a function of time. In that case the radial traverse of the rider specimen was stopped after approximately 19 seconds, and the rider was then allowed to slide in a circular track on the disk. It was obvious that an immediate and marked reduction in friction resulted. At approximately 35 seconds time a black powder was visible in the friction track and this black powder was later identified by X-ray diffraction as FeO. During the period of time from 19 to 35 seconds, the rider slid over

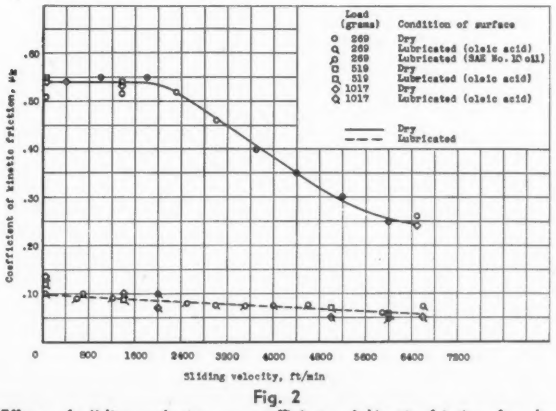

Fig. 2

Effect of sliding velocity on coefficient of kinetic friction for dry and boundary-lubricated steel surfaces.

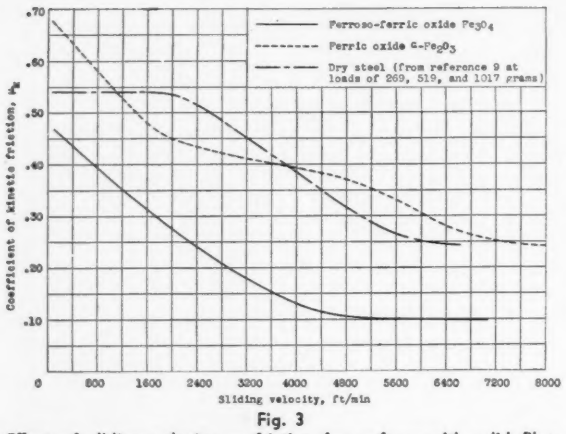

Fig. 3

Effect of sliding velocity on friction for surfaces with solid films of oxides, αFe_2O_3 and Fe_3O_4. Load, 269 grams.

the same track approximately 300 times. Simultaneously, friction stabilized at a much lower value than was the case while the rider was traversing a spiral across the disk.

An investigation of load carrying capacity of surfaces was also carried out at NACA (reference 6) and the electron and X-ray diffraction studies of that investigation showed that the occurrence of specific surface conditions could be associated or correlated with desirable or with undesirable operating characteristics of sliding surfaces. One of the principle results observed on run-in surfaces was the presence of isolated and mixed oxides of iron. By association, it was indicated that ferrous oxide FeO and ferroso-ferric oxide Fe_3O_4 were beneficial to sliding surfaces, and that ferric oxide Fe_2O_3 was not beneficial.

Experiments were, therefore, conducted with disks on which had been formed solid films of the isolated oxides Fe_3O_4 or Fe_2O_3. The film thickness in each case was approximately 1200 Angstrom units. Figure 3 includes a curve showing the friction of the Fe_2O_3 over a range of sliding velocities. This curve shows a general trend toward decrease in friction with increase in sliding velocity up to 8000 feet per minute. It was found that friction coefficient is essentially independent of load with this oxide. Figure 3 also shows the results obtained with Fe_3O_4 using 269 grams load and again friction coefficient generally decreases with increase in sliding velocity. For this oxide, however, the friction coefficient increased with greater loads (reference 2).

As compared to the dry steel, Fe_3O_4 is very effective in reducing friction (fig. 3). On the other hand, Fe_2O_3 is not beneficial when compared with the dry steel at the high and low ranges of velocity, but does produce lower friction values in the velocity range from approximately 1000 to 3800 feet per minute. In all cases, as figure 3 shows, the friction coefficient of surfaces coated with Fe_3O_4 is appreciably less than that of surfaces coated with Fe_2O_3.

Comparison of the wear data obtained with dry steel, with Fe_3O_4, and with Fe_2O_3 shows that the presence of oxides has no great effect on rate of wear. In comparison with the dry steel the presence of Fe_3O_4 caused a slight reduction in wear, and the presence of Fe_2O_3 caused a slight increase in wear. It may be noted that the relative effects of the two oxides on wear show the same trend as that observed in the case of the friction measurements (Fe_3O_4 was beneficial, and Fe_2O_3 was not generally beneficial).

Supplemental lubricants. — An analysis of the extremely high ambient temperatures and high loads occurring in turbine engines indicates that currently used hydrocarbon lubricants might be deficient. Use of supplementary or dry lubrication by solid-film materials is one method of improving lubrication under these conditions. Consideration for use as solid-film lubricants was given a number of materials, of which the physical and chemical properties of most importance from the standpoint of friction and wear are shown in figure 4. They include: (1) melting point, because of the high temperatures involved; (2) hardness, because a low hardness in a film material is associated with low shear strength and consequently low friction; (3) crystalline structure; (4) solubility; (5) chemical reactivity; and (6) tenacity for steel. This latter property is particularly important because a film material, to be effective in reducing friction between sliding surfaces, must be able to maintain itself between those sliding surfaces. The five materials listed should all be relatively effective in reducing friction and wear. Lead iodide PbI_2 and silver sulfate Ag_2SO_4 were eliminated from further consideration because of their relatively low melting points. Tungsten disulfide WS_2 was eliminated because it is difficult to obtain. The two remaining materials, molybdenum disulfide MoS_2 and graphite, were therefore indicated to be those of most interest. Both of these materials have good properties, in that each has a high melting point, relatively low hardness, and laminated crystalline structure and is relatively insoluble. The chief difference in the relevant characteristics of the two materials is that the MoS_2 has a greater chemical reactivity than does the graphite, which accounts for molybdenum disulfide's greater tenacity for steel.

	MOLYBDENUM DISULFIDE $Mo\,S_2$	TUNGSTEN DISULFIDE WS_2	GRAPHITE C	LEAD IODIDE $Pb\,I_2$	SILVER SULFATE $Ag_2\,SO_4$
MELTING PT. °C	1185	d 1250	3527	402	652
HARDNESS (Mho)	1.0-2.5	FRIABLE	1.0-2.0	-	-
CRYSTALLINE STRUCTURE	HEXAGONAL	HEXAGONAL	HEXAGONAL	HEXAGONAL	ORTHO-RHOMBIC
FORM	LAMINATED	-	LAMINATED	-	-
ORIENTATION	RANDOM	NONE	HIGHLY PREFERRED	NONE	NONE
SOLUBILITY: IN WATER	INSOLUBLE	INSOLUBLE	INSOLUBLE	SLIGHTLY	SLIGHTLY
IN ACIDS	$H_2\,SO_4$, Aq. Reg.	HNO_3 + HF	INSOLUBLE	KI	HNO_3, $H_2\,SO_4$
CHEMICAL REACTIVITY	MEDIUM	MEDIUM	LOW	MEDIUM	MEDIUM
TENACITY FOR STEEL	HIGH	MEDIUM	LOW	-	-

Fig. 4

Physical and chemical properties of solid lubricants.

Figure 5 shows the friction results obtained over a relatively wide range of sliding velocities of the two materials, MoS_2 and graphite. These results are for a load of 269 grams. The graphite film shows a trend toward increase in friction with increase in sliding velocity, whereas the friction of molybdenum disulfide film decreases with increase in sliding velocity. Curves for dry steel and boundary lubricated steel surfaces are included for comparison. At high sliding velocities the molybdenum disulfide film is nearly as effective as the oleic acid.

A study of the surfaces after friction experiments at the higher sliding velocities with the graphite film indicated that a welding and tearing-out action, such as occurs between unlubricated steel surfaces, occurred between the disk and rider. With the MoS_2 film, on the other hand, the surfaces had somewhat the same appearance as that of lubricated steel on steel, indicating no surface breakdown and no welding at any point.

The failure of graphite as a solid-film lubricant at high sliding velocities can be plausibly explained by considering the mechanism of its lubricating action as presented by Van Brunt and Savage in reference 7. They reported that the lubricating action of graphite arises from the action of adsorbed films of moisture and gases, rather than from any inherent property of the graphite structure. If an adsorbed film of water is not present, graphitic carbon may act as an abrasive. An analysis of the heat generation in the case of these sliding surfaces may, therefore, help to explain the increasing friction trend of the graphite film. Since the heat generation in general is proportional to the product of pressure and sliding velocity, it would be expected that at the higher sliding velocities more heat energy will be liberated at the sliding surfaces. The heat developed during the sliding at the high velocities is probably sufficient to cause partial desorption of the adsorbed water film on the graphite, thus partially destroying its lubricating qualities.

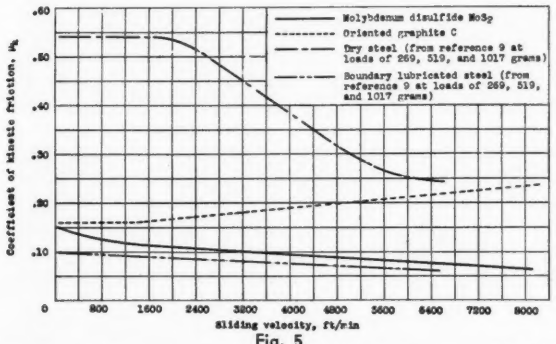

Fig. 5

Effect of sliding velocity on friction for surfaces with solid films of molybdenum disulfide MoS_2 and oriented graphite C. Load, 269 grams.

As reported in reference 8, MoS_2 is stable at high temperatures (melting point 1185°C) and pressures. Each lamina of this compound is composed of a sheet of molybdenum atoms with a sheet of sulfur atoms on each side. One of these laminæ adheres strongly to the iron surfaces because of a strong metal-sulfur bond. The other laminæ slip easily because of the weak sulfur-sulfur bond.

Additive lubricants. — As previously mentioned, an analysis of the special conditions present in the turbine-type engine, including excessive loads, high ambient temperatures, and low viscosity lubricants, indicated the need for additive lubricants of the extreme pressure or anti-weld type. Initial studies of extreme-pressure lubricants were made on dry films of the type formed by the reaction of the additives with steel. Data presented in reference 2 shows that the ferrous chloride is much more effective as a solid film lubricant than is ferrous sulfide; this result agrees generally with the comparative shear strengths of the two materials. Reference 9 reports similar results obtained in shock tests on gears lubricated with oil solutions of various sulfur and chlorine additives. These sulfur and chlorine additives were presumed to form FeS and $FeCl_2$ in actual use.

Because of the emphasis on high sliding velocities, one caution suggested itself in considerations of lubrication by extreme pressure additives. Analytical studies suggested the hypothesis that limiting conditions of sliding may be reached under conditions of high sliding velocities when the rate of sliding exceeds that rate at which effective chemical reaction between additive and sliding surfaces can proceed, thus causing failure of the

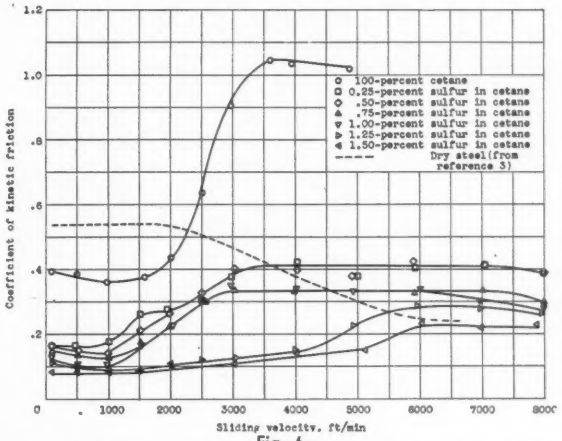

Fig. 6

Effect of sliding velocity on friction for steel surfaces lubricated with cetane containing various concentrations of free sulphur. Load, 269 grams (126,000 psi, initial Hertz stress).

lubricant. Experiments were conducted with an additive of known chemical characteristics in order to determine whether sliding velocity is a limiting factor in lubrication under these conditions. The additive was free sulfur, and the carrier was purified cetane.

Figure 6 includes the frictional results obtained with a disk lubricated with the cetane alone. As indicated, the friction is less than that for the dry steel up to approximately 2300 feet per minute. In comparing these data with the dry steel, it is of interest to note the extremely high coefficient of friction value observed after the initial failure of the lubricant film. The initial lubrication failure is indicated by the extreme increase in slope of the friction curve that occurred at a sliding velocity of approximately 1500 feet per minute. It is considered probable that the extremely high friction coefficient was produced because the bulk cetane prevented oxygen from reaching the sliding surfaces, thereby preventing the formation of oxides which would effectively reduce the friction. The roles of surface oxides on sliders have been studied and discussed by many investigators as summarized in reference 2; in particular, the results presented in reference 10 indicate that for readily oxidized materials the lack of an effective oxide film could cause friction increases of the magnitude shown in figure 6 for the cetane lubricated surfaces.

Figure 6 also shows some experimental evidence of a critical sliding velocity for various concentrations of sulfur in cetane. All concentrations of sulfur-in-cetane produced very low friction coefficients at the low sliding velocities. Above a sliding velocity of approximately 1000 feet per minute, however, an increasing trend of friction coefficient with increase in sliding velocity may be observed. Although the degree of failure may vary considerably, the initial breakdown of lubrication for all concentrations is considered to have occurred at approximately 1000 feet per minute.

In order to show more graphically that lubrication failure occurred in the range of sliding velocities at approximately 1000 feet per minute, a series of photomicrographs was obtained which shows wear areas of rider specimens after runs at various sliding velocities on a disk lubricated with cetane plus 0.5 percent sulfur. These photomicrographs, shown in figure 7, indicate normal abrasive wear occurring at sliding velocities of 1000 feet per minute or less, with no indication of surface welding. In other words, in this range of sliding

velocities the shear term of the friction equations derived by Ernst and Merchant, reference 11, and Bowden, et al, reference 12, may be considered effectively reduced, and the plowing term represents the major portion of the total frictional force. After operation at 1500 feet per minute, however, the rider surface shows evidence of appreciable amounts of material having been transferred by surface welding; although the individual welds may be of small magniture, the appearance is considered indicative of lubrication failure. At the higher sliding velocities, mass surface welding of the type shown in figure 7(e) and figure 7(f) occurred. This appearance indicates complete lubrication failure. No dimensional comparison of the wear areas shown can be made because the sliding distance was not the same in all cases. With increased loads, the critical sliding velocity remained in the range of 800 to 1000 feet per minute although the higher loads caused the slopes of the curves immediately after the break point to be much greater.

Summary of Results

Experimental investigations were conducted with kinetic friction apparatus to determine fundamental information on lubrication in the field of sliding friction. The experiments were conducted with steel specimens over a range of velocities from 50 to 8000 feet per minute and with loads of 269 to 1,543 grams (126,000 to 225,000 lb./sq. in., initial Hertz surface stress.) The following results were observed:

1. Kinetic friction of dry surfaces and of boundary lubricated surfaces decreased with an increase in sliding velocity.

2. It was possible to resolve the roles of the various oxides of iron with respect to friction and wear. The formation of ferroso-ferric oxide Fe_3O_4 on sliding surfaces is desirable; ferric oxide Fe_2O_3, on the other hand, is not generally beneficial over the entire range of sliding velocities.

3. A solid film of molybdenum disulfide MoS_2 was very effective in reducing friction at high sliding velocities. The film material was easily applied, was very tenacious, and was chemically and thermally stable.

4. In support of the hypothesis that rate of chemical reaction between surfaces and additives is a limiting factor in lubrication by extreme pressure additives, experimental results indicated definite lubrication failures at high sliding velocities. This critical sliding velocity was obtained for solutions of sulfur in cetane. Above the critical velocity friction showed an increasing trend and surface welding occurred.

Acknowledgements

The authors would like to acknowledge the very essential contributions in the experimental and analytical investigations covered in this paper of the following co-workers at the NACA, Cleveland Laboratory: Mr. Max A. Swikert, Mr. Douglas Godfrey, and Mrs. Erva C. Nelson.

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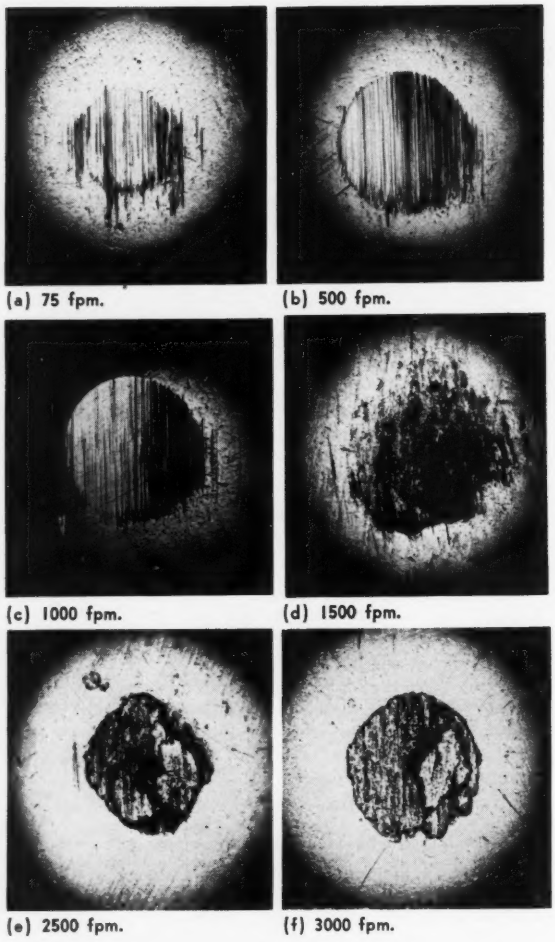

Fig. 7
Photomicrographs of wear areas after friction runs at varied sliding velocities with 269 grams load (126,000 psi, initial Hertz stress) on SAE 1020 steel lubricated with cetane containing 0.5 percent sulfur X100.

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EFFECTIVENESS OF MIST LUBRICATING AND COOLING SYSTEMS

Mr. Chamberland has a practical background of 25 years experience in tool-die making, design and general production routine. He operated an experimental shop from 1932-1940. In 1941 he joined the DoALL organization. Mr. Chamberland is the author of feature articles which have appeared in 45 diversified technical publications, including 10 overseas.

by H. J. Chamberland

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Of the many factors responsible for increased production and higher levels of quality, while endeavoring to lower costs, lubricants and coolants are obviously of prime consideration. In this super high speed age when quality and quantity are inseparable, cutting tools are subjected to considerably heavier loads than ever and therefore the necessity to dissipate heat more rapidly increases the complexities of this problem.

While a high-grade lubricant, cutting or grinding compound is expectedly selected on its merits, the fact remains that these mediums can yet prove more or less effective and even destructive to some extent. In short, the lubricant or coolant can be pumped to the location of cut at the rate of five gallons per minute and not serve its purpose efficiently. What really matters is whether or not it is directed at the point of work and tool contact every infinitesimal part of a second throughout the entire cutting process.

Research to discover means of more rapid heat dissipation has, as we know, been going on for years and great strides have been made along lines of oil-mist processes now industrially accepted as both efficient and economical. Most recent developments of this nature are in connection with modern bandsawing and surface grinding practice. Let us consider briefly to what extent modern production benefits from these new techniques.

Mist Lubrication as Applied to Sawbands

Although various lubricating methods had been resorted to in connection with laboratory customers tests to determine a sound relationship between cutting rate and tool life, none proved satisfactory until the discovery of the spray system.

The primary feature of spray lubrication is that the lubricant is forced under pressure—usually 30 to 40 pounds—directly into the saw teeth as they enter the work. The resultant rapid dissipation of heat prevents chip clogging and effects a substantial increase in tool life and cutting rate. The lubricating attachment, designed especially for vertical type band saw equipment, is readily fitted to any specialized band saw or contour sawing machine.

Using a high-grade soluble oil diluted in 40 parts of water, with air usually available from any standard air-pressure line and with metering valve set as low as possible, the lubricant actually mists or vaporizes with a consumption of less than 12 ounces per hour. Cleanliness of work and machine table are contributing factors toward efficiency and economy.

The spray lubrication system is highly effective when cutting alloy steels at conventional velocities, but it is by far more effective in relation to high speed band sawing where drip lubrication at its best is of little value. Although spray lubrication gives excellent results with high-speed sawing of many non-ferrous metals, and especially some types of plastics where friction between blade and work softens the materials to a plastic state—the greatest benefits are attained in the sawing of aluminum alloys.

The following test was executed as a means of establishing a reasonably dependable estimate of blade cost to cut a certain amount of square inches. Two machines were used, one equipped with the spray lubricating device (Figure 1) and the other cutting dry. All

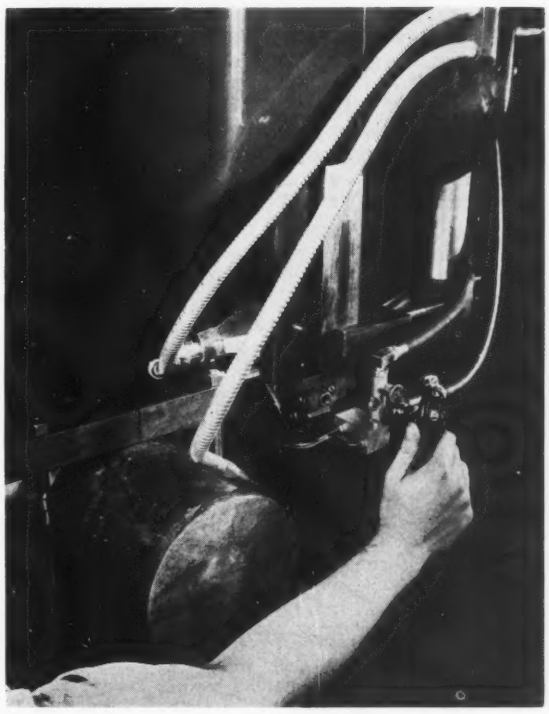

Fig. 1
Post is intentionally raised to provide clearer study of attachment. In action, oil and air emerge from their respective tube where the oil is atomized and forced directly to the saw teeth and work contact point.

blading used is ¾"—3 pitch Buttress type operating at a velocity of 3000 fpm. Material is 4 in. extruded bars of 17 ST having a 100 Brinnel hardness.

The test consisted of running 3 saws spray lubricated and 3 saws dry, designating the former as A-B-C and the latter D-E-F In an attempt to determine the exact drop in cutting rate by gradually increasing the work feeding pressure, a sharp cutting rate increase was naturally expectedly and noted at different points during the tests with saws A-B and D-E. Blade failure was determined the moment all four saws showed a cutting rate far below normal or saw lead reached ⅛ in. With these four blades the hydraulic pressure was regulated to provide a constant feeding force, whereas both other tests run with saws C-F were intended to produce a constant feeding rate.

Final results of this experiment definitely proved two facts, that it is imperative to keep the saw heavily engaged in the work at all times and proper lubrication materially increase both saw life and cutting rate. For a basis of analysis as to the value of this lubricating process as applied to any material, it is proper to proceed in terms of blade cost per square inch cut and project this cost to equal the number of square inches obtained under most efficient sawing conditions. The following comparisons show the savings effected in this case.

Saw C cut 2640 square inches at a blade cost of $6.75, when using spray lubrication, On the other hand, the dry test resulted with the F saw cost of $32.60 to cut an equal amount of square inches. Savings attributed to proper lubrication therefore equal $25.55.

It is well to consider that, in the course of research which has given industry several economical choices of general-purpose tool steels, similar progress has meanwhile been achieved in processing soluble oils that, when mixed in correct proportions, will efficiently solve at least 75% of most industrial metal cutting problems. While the 470 soluble oil previously referred to was developed particularly with saw band life in mind, it is performing exceptionally well with drilling, reaming, threading and milling, and also as a grinding coolant where high surface finishes are imperative.

A saw test to determine tool life requires ample material for conclusive facts and figures and, depending on the type of material and thickness involved, the variation in saw life may be from one to possibly five and even more hours. A test may be conducted on the basis of how many square inches the saw will cut before it begins to lead, or to determine the ultimate wear-resistant qualities of the teeth and how long it will actually cut. For example, a saw used in a recent test on 1 in. steel cut 1,170 square inches before it started to lead, yet actually cut 1717 square inches before it was discarded.

Saw tests may also be conducted on a short-cut basis —that is, by setting a certain period of cutting and comparing wear or width, set and gauge of blade with original dimensions. Saws have been known to last 18 hours and lose but 0.005 in. on the set, 0.006 in. on the width and only 0.0003 in. on the gauge. Any marked increase in cutting efficiency between hardened teeth sawbands is in greater part due to their respective heat treating techniques. The longer life saws are usually those showing absolute control over tooth hardness depth precisely at the gullet line.

The spray lubrication system is also giving excellent results with the bandsawing of marble (Fig. 2) as well as with glass, porcelain and most ceramics.

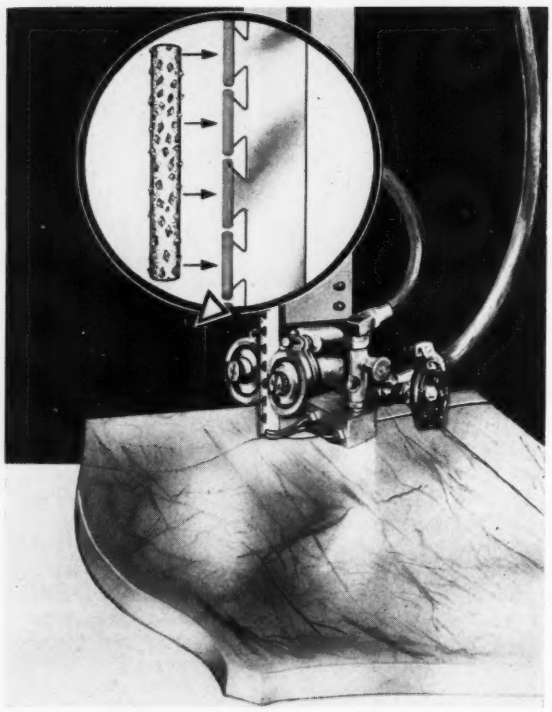

Fig. 2

Contour sawing 1¼" marble slab with diamond-tooth blade and use of spray lubricator. Proper lubrication with the bandsawing of marble, slate, glass, porcelain, etc., is imperative since diamond bands cost considerably more than other types.

Mist or "Cool" System for Precision Surface Grinding

Surface grinding equipment of the horizontal spindle-traverse table type is considered a most important link of our chain of industrial quality control, therefore, it is indispensable. With the complete realization that absolute surface grinding precision as deemed necessary today is impossible without a dependable coolant, unless the time element is immaterial, and this is not likely to be, methods to simultaneously and readily eliminate dust and dissipate heat are therefore imperative to blend quality with quantity. Conventional cooling systems, at their best, are by no means foolproof and this has been repeatedly proven by imperfections unexpectedly developing in the course of the operation.

The purpose and advantages of a highly efficient coolant system as a whole are manifold and cannot be over-estimated. Primarily and most important is its use to dissipate the heat caused by the abrading action of the grinding wheel against the work. In this connection, the following factors must constantly be borne in mind to attain maximum precision. The flow of coolant must not only be adequate but it must also be uniform in rate of flow and cleanliness, to maintain an equable temperature for minimizing distortion and avoiding minute scratches which although invisible during the grinding process will appear when the surface is being lapped.

Many operators, even though quite experienced, do not realize the high temperatures attained by the abrading action when taking a normal depth of cut with a normal amount of cross feed. Temperatures at the point of contact of wheel and work often reach 2200 F for the harder steels and around 1500 F for mild steels.

(*Continued on page* 36)

CURRENT LITERATURE

American Chemical Society, Division of Water, Sewage and Sanitation Chemistry, Abstracts, 116th Meeting, Atlantic City, New Jersey, Sept. 18-23, 1949

EVALUATION OF DETERGENTS, CORRELATION OF WASHING PERFORMANCE WITH DISSOLVING AND WETTING ABILITY
Norris, F. I. and Ruchhoft, C.C.—p. 7S

A series of about 100 commercial detergents and detergent components representing different types of detergents was included in a study involving the application of the washing performance test and the determination of the various factors of detergency. The factors determined included pH, phenol-phthalein, inactive and total alkalinity, surface tension, interfacial tension, and emulsification with mineral oil and sequestering ability. It was found possible to correlate correctly with washing performance 100% of the soaps, 95% of the surface active agents, 91.7% of the alkaline detergents, and 87.5% of the combined detergents studied.

OXIDATION CHARACTERISTICS OF LUBRICATING OILS AT HIGH TEMPERATURES
Diamond, H., Kennedy, H. C. and Larsen, R. G. —pp. 31-45

A new technique has been developed for measuring the oxidation velocity of lubricating oils in thin static films at high temperatures (220°-275°C.). Effects of variation in film thickness and temperature have been determined; the apparent energy of activation has been found to increase with rising temperature. Several metals have shown various degrees of catalytic activity. Consideration of rate data together with the geometric characteristics of the reacting system leads to the conclusion that catalysis even by metallic copper involves a predominantly homogeneous mechanism. It is suggested that such measurements may aid in explaining the behavior of oils in the power-section of internal-combustion engines as well as in some industrial applications.

Analytical Chemistry, Vol. 21, No. 8, August, 1949

IDENTIFICATION OF PENNSYLVANIA LUBRICATING OILS BY INFRARED ABSORPTION
Fred, M. and Putscher, R.—pp. 900-911

Evidence of the existence of olefins in certain sources of crude petroleum is presented. These olefins were identified by means of a characteristic infra-red absorption band at 10.3 microns. These olefins have been found in all crudes examined from the Pennsylvania grade field and not in other crudes, with the exception of a few nearby fields of mixed crude type. They are easily observable in finished lubricating oil, and hence their absence from an oil is evidence that the oil did not originate in Pennsylvania grade crude.

Brennstoff-Chemie, Vol. 30, No. 17-18, September, 1949

CONTRIBUTION TO THE TESTING OF LUBRICANT BEHAVIOR
Halder, R.—pp. 306-312

This article takes up experiments carried out during 1938-1945 at Oppau.

LUBRICANT BEHAVIOR AND CHEMICAL COMPOSITION
Halder, R.—pp. 313-314

Lubricant requirements are constantly growing. In recent years synthetic substances have been tried. The work here reported was carried out at Oppau during 1941-1944. A list of 20 synthetic combinations (esters) was investigated. A table gives the viscosity of these ester combinations.

SHORTCOMINGS AND LIMITS OF THE VISCOSITY INDEX
Gottner, G. H.—pp. 314-319

The author gives a review of the development of the viscosity index, taking up the old viscosity index, the new viscosity index, viscosity index zones, kinematic viscosity index and independent viscosity index. He considers viscosity system and temperature range as well as reference system and evaluation system.

Canadian Journal of Research, Section B, Vol. 27, No. 7, July, 1949

FLOW PROPERTIES OF DISPERSIONS OF CALCIUM SOAPS IN HYDROCARBON OIL
Moses, G. B. and Puddington, I. E.—pp. 616-628

The flow properties of dispersions of calcium soaps in hydrocarbon oils have been studied over a range of temperature from 35° to 90°C., and rates of shear from 500 to 16,000 sec.-1 by extrusion through a capillary plastometer. The thixotrophy of the system falls as the temperature is increased to 50°C. and then rises to a maximum of 65°C., after which it falls regularly. This behavior is discussed.

Chemie-Ingenieur-Technik, Vol. 21, No. 11-12, June, 1949

EXTRACTION OF MINERAL OILS WITH SELECTIVE SOLVENTS
Terres, E.—pp. 209-218

The recently acquired understanding of the inter-relations in the field of mineral-oil refining with selective solvents allow of the development of new analytical methods which are superior to the known methods and open up vistas into the composition of oils, which could not be obtained up till now.

EFFECT OF THE NATURE OF THE LUBRICANT ON FRICTION AND WEAR IN BOUNDARY LUBRICATION
Ramsauer, R. Dr. and Wolf, K. L., Dr.— pp. 216-218

The addition of small quantities of surface-active materials to a lubricant may reduce the coefficient of friction but at the same time give rise to an increase in the wear and tear of material.

THE BLUEMNER HIGH - PRESSURE CARBONIZATION PROCESS
Thau, A.—p. 230
(Erdoel u. Kohle 2,127/33, 1949)

The Bluemner process yields a higher output of oil, in particular light oils.

SIZE AND DISTRIBUTION OF ACTIVE CENTERS ON METAL SURFACES
Erbacher, O.—p. 232
(Z. Elektrochem. 53m 54/67, 1949)

Edges and corners are not in any way superior to the other parts of the metal surface. The active centers are uniformly distributed all over the metal surface. Adsorption tests have shown that the reacting spots are of atomic and not of macroscopic size.

Chemical Abstracts, Vol. 43, No. 7, April 10, 1949

NEW INDUSTRIAL VISCOMETER
Desalme, R. and Persoz, B.—pp. 2474-5
(J. recherches centre natl. recherche sci., Labs. Bellevue (Paris), 1948—pp. 130-1)

A new viscometer is described consisting of a rigid pendulum, rotating about a point slightly above its center with small rectangular plate fastened to its lower end. Viscosity is related to time needed for pendulum to move from an angular displacement of about 12 degrees to about 4 degrees and this time depends upon the viscosity of the liquid into which the plate at the lower end of the pendulum is immersed, temperature of the liquid and constancy of the dimensions of liquid container.

Vol. 43, No. 12, June 25, 1949

REGENERATING ACTIVE EARTHS USED IN PURIFYING OILS
Rhenania-Ossag Mineralolwerke A.-G.—p. 4844
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(Zavodskaya Lab., Vol. 15, 1949—pp. 157-8)

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Sun products have been "Job Proved" in the lubrication of almost every type of mining, manufacturing, power, and transportation equipment . . . in refrigeration and air-conditioning . . . in metal cutting, tempering, and quenching . . . in the processing of textile fibers, leather, natural and synthetic rubbers . . . in the impregnation of electrical, electronic, and packaging materials of many kinds.

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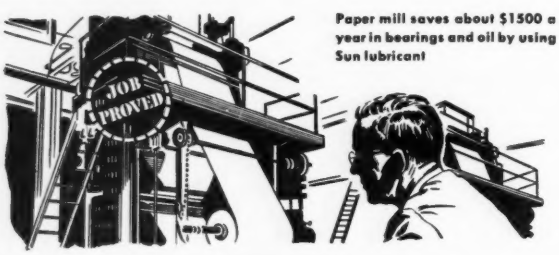
SUNVIS 900 OILS—High-viscosity-index, paraffinic-type oils—of uniform O F pour point—fortified against rust, corrosion, oxidation, and sludge. The finest available lubricant for turbines, hydraulic systems, and similar applications.

SUNVIS HD 700 OILS—High-viscosity-index oils containing additives which minimize oxidation and give detergency. Ideal lubricants for internal combustion engines subjected to continuous heavy loads under the most adverse conditions.

SUNVIS OILS—Solvent-refined paraffinic-type oils of uniform high viscosity index, low pour point, and low carbon content. Especially suitable for application to long-time use in all types of industrial reservoirs and circulating systems.

DYNAVIS OILS—Low-pour-point, high-viscosity-index, inhibited oils, containing an additive which helps prevent formation of harmful corrosive and sludge-forming acids. Well suited for engines fitted with alloy bearings and operated at high temperatures.



Paper mill saves about $1500 a year in bearings and oil by using Sun lubricant

SOLNUS OILS—Well-refined straight mineral oils. Stand up under hard use for long periods of time. Recommended for use in machine tools, air compressors, certain types of diesels, etc.

CIRCO OILS—Used for general lubrication of industrial machinery when straight mineral oils are required.

SUNTAC OILS—100%-petroleum products which have been compounded to increase their adhesiveness. Recommended for general lubrication of all machines subjected to sudden shocks and load reversals. Cling to the parts to be lubricated.

STEAM CYLINDER OILS—High flash and fire point lubricants for either saturated or superheated steam conditions and for worm-gear speed-reduction units.

SUN CAR JOURNAL OILS—Dark oils meeting A.A.R. Specifications. For use in waste-packed bearings of railroad equipment.

SUN DELAWARE OILS—Dark oils for general lubrication on older types of industrial machinery.

SUNOCO WAY LUBRICANT—For use on tableways. Eliminates chatter and scoring . . . resists corrosion. Has good metal-wetting and adhesive properties, ample viscosity, and E. P. qualities.

SUN MARINE ENGINE OILS—Compounded with special emulsifying agents in order to provide adhesion to, and lubrication of, working parts in the presence of water. For the lubrication of bearings, eccentrics, crossheads, and various other parts of steam engines.

ROCK DRILL OIL—High-film-strength adhesive oil. For use in jackhammers, stopers, drifters, and similar equipment.

INDUSTRIAL GREASES

SUN CUP GREASES—Water resistant. For grease-cup and grease-gun application when service is normal.

SUN GUN GREASES—Smooth greases made with medium-viscosity oil. Stable under pressure in power and booster guns.

ADHESIVE PRESSURE GREASES—Won't drip or splash. Excellent lubricants for open-gear applications.

SUN DARK PRESSURE-SYSTEM GREASES—For power-driven central grease lubricating systems in heavy industries. Also used as a "medium cup grease."

SUN MINE CAR GREASES—Available in several grades. Suitable for both antifriction bearings and plain-bearing cavity-type wheels.

SUN MINING MACHINE LUBRICANT—Semifluid. For use where a light but adhesive grease is required. Resists separation and decomposition.

Chemical plant saves about $8000 per year by adopting Sun Pressure Grease

SUN ROLLER BEARING GREASES—For use on electric motors and generators and high-temperature machinery equipped with ball or roller bearings.

SUN GEAR COMPOUNDS—Black adhesive open-gear compounds and

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SUN PETROLEUM

SPEED PRODUCTION, IMPROVE QUALITY

wire-cable greases. Recommended for power presses, mining machinery, worn reduction mills, crushers, pump gears, etc.

SUNOCO TRACTOR ROLLER COMPOUND—For crawler-type tractors. Provides good lubrication with exceptional sealing qualities.

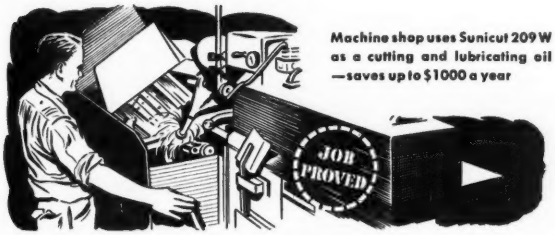
METALWORKING OILS

SUNICUT—Straight (non-emulsifiable) transparent cutting oils. Recommended for automatic screw machines and heavy-duty machining operations. Permit high speed production with excellent finishes, long tool life.

SUNOCO EMULSIFYING CUTTING OIL—A self-emulsifying oil which produces a stable white emulsion. Efficient and economical cooling and lubricating medium for turning, milling, drilling, and other metalworking operations on both ferrous and nonferrous metals. It is also an excellent grinding coolant.

SUN QUENCHING OILS—Specially refined oils designed to aid development of maximum physical properties in a wide variety of steels.

SUN TEMPERING OILS—Specially refined oils for tempering steel. Because of their low carbon content and stability under heat, these oils have an unusually long service life.



Machine shop uses Sunicut 209W as a cutting and lubricating oil—saves up to $1000 a year

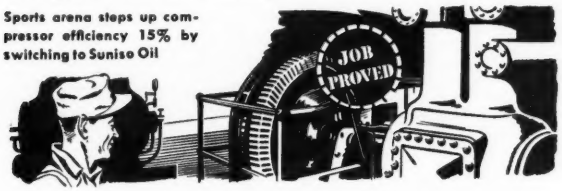
SUN ROLLING OILS—Straight and emulsifying oils which will permit maximum production in rolling steel, aluminum, brass, and copper.

SUN ANTI-RUST COMPOUNDS—Petroleum-base oils with chemical additives designed to prevent the rusting and corrosion of steel.

REFRIGERATION OILS

SUNISO REFRIGERATION OILS—Have extremely low pour points, extremely low wax-separating characteristics, a high degree of stability and long life. Initially neutral and resistant to formation of detrimental acids under service conditions. Suniso Oils are high quality oils suitable for both high- and low-temperature operations. The most widely used oils in refrigeration and air-conditioning.

Sports arena steps up compressor efficiency 15% by switching to Suniso Oil



TEXTILE-PROCESSING OILS

SUNOTEX TEXTILE OILS—Designed to impart certain additional properties to various forms of fibers during their processing from the fiber state into a manufactured product. All Sunotex textile oils are emulsifiable in water. Highest rating in fadometer tests.

SUN COTTON CONDITIONING OILS—Pale mineral oils which condition the cotton. They prevent waste by cutting down excessive amounts of "fly" (fine air-borne lint particles).

Worsted mill obtains easier scouring, better quality, larger yield with Sunotex WO-220

SUN ASBESTOS FIBER CONDITIONING OIL—Used for spraying on the asbestos during processing. Fibers are kept from being damaged or broken down, and harmful dust is minimized when this product is used.

SUN CORDAGE OILS—Generally used alone, but are adaptable to various formulas used by cordage manufacturers. Selected products, highly compatible with additives.

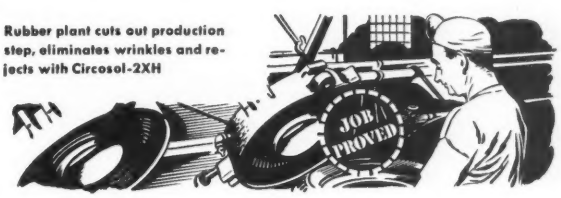
RUBBER-PROCESSING AIDS

CIRCOSOL-2XH—An elasticator and processing aid for natural rubber and especially for GR-S. Outstanding for sponge rubber.

CIRCO LIGHT PROCESS AID—A processing agent and excellent softener for natural rubber, natural rubber reclaims, and neoprene synthetic rubber. Used for GR-S to some extent.

SUNDEX-53—An inexpensive product suitable for processing GR-S and blends of GR-S and natural rubber. An established processing aid for rubber footwear stocks and semihard rubbers.

Rubber plant cuts out production step, eliminates wrinkles and rejects with Circosol-2XH



CIRCOMAR-5AA—A black-colored product for processing natural and GR-S rubber used in tire-making. Also used in reclaiming natural-rubber scrap. Replaces asphalt fluxes. Free-flowing at room temperature.

WAXES

Sun's new wax plant was completed in 1949. Its many refining innovations and extreme flexibility permit new types of waxes to be manufactured in large quantities—a procedure heretofore impracticable. A wide range of fully refined paraffin and microcrystalline waxes will be "tailor-made" to meet the requirements of virtually all major industrial applications. Pilot plant samples of several grades are now available.

MISCELLANEOUS INDUSTRIAL PRODUCTS

SUN SOLVENTS—Sun Spirits for the thinning of paints, varnishes, and enamels, and for metal-cleaning . . . a pure, water-white petroleum solvent free of corrosive sulphur. Other Sun solvents with special properties are available for the chemical industry.

SUN LEATHER OILS—Mineral-base leather oils. Used for obtaining the desired tensile strength, proper temper, and controlled moisture content. Maintain a light even color . . . mix well . . . distribute evenly.

"JOB PROVED" IN EVERY INDUSTRY

PRODUCTS

SUNOCO

INFLUENCE OF SEVERAL FACTORS IN DETERMINATION OF SULFUR IN DARK PETROLEUM
Eigenson, A. S. and Yakhina, P. D.—p. 5575
Zavodskaya Lab., Vol. 15, 1949—pp. 147-56)

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DETERGENTS AND THEIR COMPOSITION
Lindner, K.—p. 6436
(Seifensieder-Ztg., Vol. 72, 1946—pp. 174-6)

PROBLEMS OF THE PRODUCTION OF LIQUID FUELS FROM COAL
Vorberg, G.—p. 6390
(Seifensieder-Ztg., Vol. 72, 1946—pp. 146-9, 166-8)

A NEW METHOD FOR THE SOLIDIFICATION OF PETROLEUM PRODUCTS. (GASOLINE, KEROSENE, SOLAR, MAZUT, ETC.)
Turetzky, S.—p. 6398
(Hebrew Tech. Coll., Haifa (Inst. Technol.), Sci. Pubs., Vol. 3, 1948—pp. 82-4 in Hebrew, XX in English)

ETHYLENE√—GLYCOLS
Lozac'h, N.—p. 6162-3
(Bull. soc. chim. France, 1949—pp. 286-8)

PREPARATION OF DIETHYLENE GLYCOL
Moureu, H., Dode, M. and Dode, H.—p. 6163
(Mem. services chim. etat (Paris), Vol. 33, 1947—pp. 409-15)

RELATION BETWEEN REFRACTIVE INDEX AND VISCOSITY
Banerji, B. K.—p. 6024
(Current Sci. (India), Vol. 16, 1947—p. 283)

THE DETERMINATION OF CORRECTIONS IN VISCOMETRY.
Lederer, E. L.—p. 6024
(Schweiz. Arch. angew. Wiss. Tech., Vol. 14, 1948—pp. 372-7)

DETERMINATION OF THE SURFACE AREA OF ADSORBENTS
Zhukhovitskii, A. A. and Rubinshtein, R. N.—p. 6036
(Doklady Akad. Nauk, S.S.S.R., 1949, Vol. 66—pp. 73-5)

THEORY OF THE VISCOSITY OF LIQUIDS REPLY TO KHEIN
Panchenkov. G. M.—p. 6024
(Zhur. Fiz. Khim., Vol. 23, 1949—pp. 500-3)

BASIC STRUCTURAL TYPES OF ADSORPENTS AND THEIR EFFECT ON ADSORPTIVE PROPERTIES
Kiselev, A. V.—pp. 6033-4
(Zhur. Fiz. Khim., Vol. 23, 1949—pp. 452-68)

CUTTING OILS FOR MACHINING METALS
Winkelmann—p. 6400
(Werkstatt u. Betrieb, Vol. 89, 1947—pp. 143-4)

THE EVALUATION OF FUELS
Draws, R.—p. 6389
(Gas- u. Wasserfach., Vol. 90, 1949—pp. 212-17)

Vol. 43, No. 19, October 10, 1949

CONTINUOUS STILL FOR OIL-EXTRACTION UNITS
Arias, R. S.—pp. 7269-70
(Ion, Vol. 9, 1949—pp. 289-95)

The advantages of continuous versus batch distillation of solvent from oil-solvent mixtures are described. The case of continuous distillation of such a mixture in which the solvent is trichloroethylene and the oil is of molecular weight 850 is treated theoretically.

CAUSES OF OCCUPATIONAL DERMATITIS
Schwartz, L. and Birmingham, D. J.—p. 7605
(Safety Eng., Vol. 98, No. 1, 1949—pp. 56-9)

CARBON TETRACHLORIDE CAUSES TWO DEATHS IN INDUSTRY
Bell A. P. and Mitchell, W. A.—pp. 7605-7606
(Ind. Hyg. Newsletter, U.S. Public Health Service, Vol. 9, No. 8, 1949—pp. 4-13)

RETORTING METHOD FOR RECOVERY OF OIL SHALE. DETAILS OF EQUIPMENT DEVELOPED BY THE UNION OIL COMPANY
Reed. H. and Berg. C.—p. 7671
(Mech. Eng., Vol. 71, 1949—pp. 639-42)

GUIDE FOR THE LUBRICATION OF MILITARY AIRCRAFT
Glass, E. M.—p. 7675
(Aero Digest, Vol. 58, No. 2, 1949—pp. 65-6, 68-70, 72, 74)

Tables give information on the characteristics of the major greases and oils used by the U.S. Air Force, lubricants employed, and typical applications.

EFFECT OF THE RATE OF COOLING ON THE PROPERTIES OF LUBRICATING OILS AT LOW TEMPERATURES
Val'dman, V. L.—p. 7675
(Kolloid. Zhur., Vol. 11, 1949—pp. 137-40)

INFLUENCE OF THE PRESSURE OF THE EXTERIOR GAS ON THE UNCTUOSITY OF LUBRICANTS
Volovick, G.—p. 7675
(Compt. rend., Vol. 227, 1948—pp. 1354-6)

THE USE OF GRAPHITE AND ADDITIVES IN LUBRICATING OILS
Sainz, A. F.—p. 7675
(Bol. inform. petrol. (Buenos Aires), Vol. 26, 1949—pp. 41-60)

A review with 21 references to the periodical literature and citations of many patents.

THE EFFECT OF THE LUBRICANT UPON THE ENERGY AND MATERIAL LOSSES IN BOUNDARY LUBRICATION
Ramsauer, R. and Wolf, K. L.—p. 7675
(Chemie, Ing., Tech., Vol. 21, 1949—pp. 216-18)

Chemical and Engineering News, Vol. 27, No. 26, June 27, 1949

DIRECTORY OF TECHNICAL TRANSLATORS
Anon.—p. 1889

A Directory of Translators has been established by Science-Technology Group of Special Libraries Association. The directory is operated as a free service to bring together clients having translation problems and language specialists competent in various subject fields in science and technology. Individual or firms needing qualified translators are invited to address inquiries to Wayne Kalenich, Southwestern Research Institute, San Antonio, Tex., and translators are urged to place their qualifications on file with the directory. Twenty-three different languages are already included among the specialists listed. Mr. Kalenich also conducts the Translation's Pool which records the existence of technical translations within private file in the U.S., and the conditions of their loan or purchase. Persons contemplating the translation of a technical article are urged to make a preliminary check with Mr. Kalenich to be sure that such a translation is not already available.

NEW GLYCOLS SYNTHESIZED
Anon.—p. 1892

The initial synthesis of two new glycols has been accomplished by Carbide & Carbon Chemicals Corp. These glycols are substituted 1,5-pentanediols: 2-methoxymethyl — 2,4-dimethylpentanediol — 1,5 and 2-ethoxymethyl — 2,4-dimethylpentanediol-1,5.

Vol. 27, No. 28, July 11, 1949

NEW APPROACHES TO WASTE DISPOSAL PROBLEMS SUGGESTED
Anon.—p. 1998

The symposium, sponsored by the Sanitation Study Section of the National Institutes of Health, was held in Washington, D. C., June 23 and 24, 1949. The topics discussed are reported, including sterilization of sludges, halogen reactivity, new analytical methods and the need of standard methods for waste disposal.

Vol. 27, No. 30, July 25, 1949

DEFOAMING OIL
Anon.—p. 2162

Lubricating oil can be satisfactorily defoamed by recycling it through a column of activated charcoal, according to a report prepared for the National Advisory Committee for Aeronautics. A particular type of aircraft lubricating oil was recycled through a charcoal column at 50°C. or lower, after which at 100°C. it produced only one tenth of the volume of foam as compared to the untreated oil. Activated magnesium oxide, silica gel, and Porocell, packed in colums for recycling, also defoamed the oil, but not to the same extent. "Attempts to Defoam Existing Oils by Processing", may be obtained without charge. National Advisory Committee for Aeronautics, Washington 25, D. C., as their Technical Note 1845.

Vol. 27, No. 35, August 29, 1949

INDUSTRY'S CONCEPT OF COOPERATIVE RESEARCH
Stephens, H. N.—pp. 2476-2479

The paper was presented at the Symposium on Engineering Research, March 14 to 16, 1949, sponsored by the Institute of Technology of the University of Minnesota and the Minnesota Branch of the American Society of Engineering Education. Discussing the idea of cooperative research, the author states that partnership based on mutual respect and confidence should be a prerequisite to establishment of any industry-sponsored research project at a university. The motives which may be behind the establishment of a cooperative research organization at a university and the pro and con arguments with reference to the university research are cited. Organization should serve, not run, research.

SOLVENT INTRODUCED
Anon.—p. 2507

Wyandotte Chemicals Corp. announces the commercial availability of Betachlor, a product consisting of beta, beta'-dichloroethyl ether (approx. 57%) and beta, beta'-dichloroisopropyl ether (approx. 43%). Because of its excellent solvency for oils, fats, waxes, and greases, Betachlor is expected to assume an important role in extraction processes, textile processing, and in the formulation of many types of cleaning compounds. Advantages aiding in the use and recovery of this product include a boiling range of 160°C. to 183°C., water insolubility, and a flash point of 190°F.

API PROJECT 48.SYNTHESIS, PROPERTIES, AND IDENTIFICATION OF SULFUR COMPOUNDS IN PETROLEUM
Seyfried, W. D.—pp. 2482-2486, 2516

The increasing rate of production and refining of high sulfur contents crudes in recent years has directed considerable research toward the problems associated with the presence of sulfur in petroleum. Measurements of sulfur compounds and of their thermodynamic properties, sulfur compounds in crude oils and petroleum distillates, and methods of synthesis and identification are discussed.

Vol. 27, No. 36, September 5, 1949

HIGH CONSISTENCY ROTATIONAL VISCOMETER
Anon.—p. 2570

A high consistency rotational viscometer has been developed by Precision Scientific Co. in cooperation with the Texas Co. to measure the viscosity of asphalt and related viscous substances. When testing high consistency liquids, it will determine the viscosity, the degree of flow complexity, and the relative elasticity.

Vol. 27, No. 38, September 19, 1949

INTERCHEMICAL ROTATIONAL VISCOMETER
Anon.—p. 2728

Precision Scientific Co. has redesigned the Interchemical Rotational Viscometer and placed all operating parts within one housing. The viscometer produces con-

sistency curves in place of single point measurements which are usually misleading for plastic, thixotropic materials. It consists essentially of a rotating sample cup and a stationary bob immersed in it.

Vol. 27, No. 39, September 26, 1949

THE COST OF CORROSION TO THE U.S.
Uhlig, H. H.—pp. 2764-2767

The paper was presented at the United Nations Scientific Conference on the Conservation and Utilization of Resources held at Lake Success, Sept. 1, 1949. A comprehensive survey on corrodible equipment is given. The author discusses the corrosion indirect losses, losses incurred through over-design, direct losses, reduction of corrosion losses, including cathodic protection, use of inhibitors and other protective measures. Possibilities of various metals and proposed research program is taken up. Sixteen references are given.

EXPERIENCE PATTERNS OF INDUSTRIAL RESEARCH LEADERS
Carpenter, M. T.—pp. 2768-2769

The paper was presented at the annual meeting of Industrial Research Institute, Inc., Asbury Park, N. J., May 24 to 25, 1949. A survey of the qualities characteristic of the very top-level industrial research executives is presented. The purpose of the present study was to find out a few of the factors which enabled the top-level industrial leaders to reach the top, and also to learn what advice these successful men might wish to offer to younger scientists. The paper is based on a questionnaire sent to 160 representatives of various companies to the Industrial Research Institute. Replies were received from 84%, an unusually high proportion.

CHEMISTRY AND THE WORLD OF TODAY
Pauling, L.—pp. 2775-2778

The points of this presidential address stressing the contributions of chemical industries to the modern world, are: the importance of the organization of a national scientific research foundation, the danger in having basic scientific research in our universities supported exclusively or predominantly by the Federal Government (the danger of bureaucratic control of the universities and of scientific research), and the necessity of the support of the proposed research organization by the nation's industrial corporations essentially without restrictions as to the way in which the money will be expended. The support of a scientific research foundation by the nation's industrial corporations offers insurance that the corporations will have new products to manufacture in the future. Such a project could be maintained by investing only 0.375% of profits.

SELF-LUBRICATING CARBON SEAL
Anon.—p. 2804

Morganite, Inc., has announced a new self-lubricating mechanical seal capable of withstanding corrosive chemicals, and requiring no attention for lubrication during the life of the seal. This feature makes Morganite adaptable for installation in inaccessible locations where maintenance and servicing would be difficult and, in many cases, would require costly shut downs of equipment. The new Morganite Self-Lubricating Carbon Seals are recommended for use in pumps, agitators, mixers, and similar installations handling corrosive, volatile or otherwise difficult-to-handle liquids.

HYDRAULIC FLUID
Anon.—p. 2800

Celanese Corp. of America has announced that the development and production of Lindol HF-X, a flame resistant tricresyl phosphate base hydraulic fluid. Because Lindol HF-X is not a chlorinated compound, it does not give off noxious fumes when exposed to very high temperatures. The possible use of Lindol HF-X by diecasters and users of hydraulically operated installations is suggested.

Vol. 27, No. 46, November 14, 1949

SYNTHETIC LIQUID FUELS
Gibbs, R. G.—p. 3337

Two bills are pending to expand greatly the limited synthetic liquid fuels program of the Bureau of Mines which, at present, is restricted largely to research and demonstration plant scale production of such fuels from coal and oil shale. The proposed bills would support private research and make loans to private industry to construct several commercial scale plants. Hearings on these bills were postponed until the second session since it was believed that there would have been insufficient time to complete legislative action on the bills following the hearings. A related bill would authorize construction of a $1 million research station, plus $100,000 per year operating costs, for the production of petroleum and natural gas from coal in the Hocking Valley area of Ohio. This bill was not reported out of committee.

OIL CHEMISTS HEAR NEW DEVELOPMENTS
Anon.—pp. 3352-3353

Synthetic detergents, solvent extraction and modification and coversion of oils were discussed before the American Oil Chemists Society's 23rd fall meeting in Chicago, Oct. 31, 1949. Synthetic detergents came in for a strong share of attention. Comparisons were made with soap and suggestions offered for taking advantage of the superior characteristics of both through combinations. A number of test methods were described. Two papers dealt with the studies directed towards the understanding of the process of solvent extraction and the effect of particle size on extraction rate. Menhaden oil, the lowest priced glyceride available in commercial quantities was shown to be a source of excellent yields of high molecular weight unsaturated alcohols, by means of sodium reduction. The alcohols thus formed could then be selectively hydrogenated catalytically to give a colorless product substantially free from odor. Hydrogenation plants and selective esterification of tall oil were taken up.

SULFONATED OILS
Stenerson, H.—p. 3450

The author states that sulfonated oils, far from being outmoded by newer products, are still being taken in volume for textile, leather, and paper processing. Brief statistical data are given. Turkey red oil (product of sulfation of castor oil), inedible tallow, various fish oils and other animal and vegetable sulfonated oils are taken up. "Petroleum sulfonates" are not new but represent a comparatively recent development in this old industry of sulfonated oils. They are principally by-products obtained in the manufacture of white oils and occur in the form of oil and water solubles.

Chemistry, Vol. 23, No. 1, September, 1949

SYNTHETIC DETERGENTS FOUL THE WORKS
Anon.—p. 36

Synthetic detergents may be a boon to the housewife, but they are also under suspicion from chemists. Soapless soaps are suspected of being to blame for settling tanks not settling. William Gallagher, superintendent of the Appleton, Wis., Water Department, calculated the amount of detergents causing the difficulty at his plant on the order of one part per million. Methods of analyzing for smaller quantities should be developed and ways of decomposing the compounds need to be found.

METAL CORROSION PROBLEMS
Anon.—pp. 37-38

Cathodic protection, first used in 1824 by Sir Humphrey Davy, is one of the most effective means of preventing or arresting corrosion. This can be accomplished in most cases by introducing a current to offset the one produced by the difference in potential. By far the most important application of cathodic protection has been in connection with the thousands of miles of underground oil, gas and water pipe lines, and power and communication cables. Good design for metal structures avoids crevices favorable to corrosive action. One of the most effective means of increasing the durability of the elemental metals is to combine them in alloys or to control their minor constituents so as to achieve the corrosion-resisting properties desired.

Chemistry & Industry, No. 28, July 9, 1949

DETERGENTS AND DETERGENCY
Snell, F. D., Dr.—pp. 499-500

The wide use of detergents in cleansing the skin, teeth, clothing, dishes, the hair, and the floor, not to mention innumerable uses in the industrial field is discussed. Detergents are surface active agents, although perhaps the expression "inter-face chemistry" might be happier than "surface chemistry," and detergency may be visualized as a variety of emulsification. The production of detergents from petroleum or gaseous olefins has progressed enormously as a result of the world-wide fat shortage, and in less than ten years production has reached a level of from 10% to 20% of that of soap. This advance will continue to increase, synthetic detergents from petroleum sources costing less per pound to manufacture on a large scale than does soap.

No. 30, July 23, 1949

SILICONES
Advertisement, Albright & Wilson (London) p.V

A shortened list of the practical applications of silicones (liquids, resins, silastics, greases and compounds) is presented.

Corrosion, Vol. 5, No. 7, July, 1949

CORROSION RESEARCH IN THE NAVY
Harwood, J. J. and Schulman, F.—pp. 203-217

Of all the industrial and military activities concerned with the destructive effects of corrosion phenomena, the Navy may be considered to be the most seriously affected. The object of this article is to describe the Office of Naval Research (ONR) corrosion research program and its objectives and to review briefly the progress to date. The authors describe briefly the prevalent types of corrosion encountered throughout the Navy and the general methods currently employed to control them.

(*Continued on page* 43)

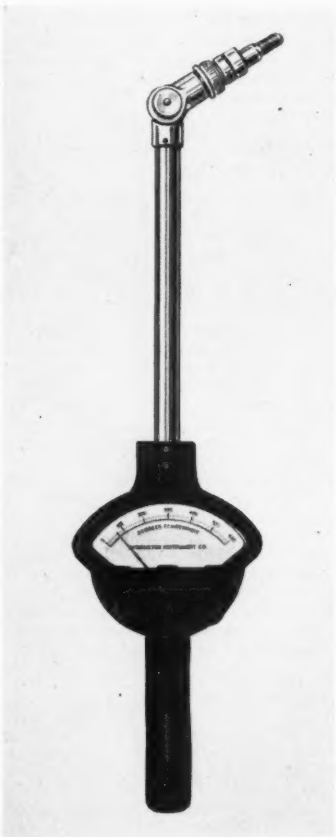
NEW PRODUCTS and EQUIPMENT

Mixing Motors: Aro Equipment Corp., Bryan, Ohio—A new and versatile portable mixing motor for mixing, emulsifying or stirring operations in industrial plants, with unusual features embodying a wide choice of motors and accessories, fully adjustable mounting clamp, and easy needle valve adjustment for complete speed control, explosion-proof, and impervious to chemical fumes, is announced. A swivel clamp permits easy adjustment to desired angle. Five models are offered with speeds of from 500 to 17,000 RPM. In the petroleum industry, they are applicable to lube oil blending and general laboratory work. Stirring rods are available in ¼″ and ½″ diameters and in lengths of 12″, 18″ and 24″.

Revised Edition: American Cyanamid Company, 30 Rockefeller Plaza, New York 20, N. Y.—Now available "Products and Services of American Cyanamid Company for Industry and Agriculture." This book describes the products and services which the above company offers to industry. Copies furnished upon request.

New Literature: Swan-Finch Oil Corp., RCA Bldg., West, New York 20, N. Y.—Safco 770 Compound with a consistency of a liquid paste, is recommended by the manufacturer as an all-purpose coolant base for both grinding and machining operations, combining in a single water-soluble product all of the essential qualities of a grinding compound and a sulphurized cutting oil. It is claimed that this compound exhibits the same fine lubricating and anti-weld properties of sulphurized oils—without smoke, odor, dermatitis, or burnt hands. Literature is available on request.

Surface Pyrometer: The Pyrometer Instrument Co., Inc. Bergenfield, N. J.—A completely self-contained, portable, compact and quick-acting instrument with a wide selection of thermocouples is claimed by the manufacturer to be ideally suited to almost every industrial surface and sub-surface temperature measurement problem. The new instrument features 4″ direct reading indicator and two series of models offer either a rigid extension arm or a 42″ flexible arm suitable for use with all of the eight types of available thermocouples. The instruments are furnished with various temperature ranges. Illustrated catalog No. 180 obtainable upon request.



Trico Broadside: Trico Fuse Mfg. Co., 2948 N. 5th St., Milwaukee 12, Wis.—A complete condensed catalog of lubricating devices describing their entire line with suggestions for proper application, thus eliminating guess work in hand oiling, is announced by the above company. Broadside 4800-OB available on request.

Bucket Pump: Lincoln Engineering Co., 5743 Natural Bridge Ave., St. Louis 20, Mo.—Announcing a new high pressure bucket pump for delivering lubricant to circuits of Centro-Matic lubricant injectors installed on one or more machines not equipped with pump. The model includes a Flex-O-Matic coupler with adapter. It is equipped with a 5 ft. hose and a pressure gauge is incorporated in this model. Write for descriptive bulletin 800-1.

Application Guide: Keystone Lubricating Co., 21st and Lippincott Sts., Philadelphia 32, Pa.—A presentation of their line of specialized lubricants for industrial and automotive machinery, with tested recommendations for lubricating all types of bearings under various operating conditions. Write for your copy.

Turbine Lubrication: E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.—The problems of oxidation, emulsification, foaming and sludging, as related to turbine lubrication, are discussed in a folder entitled "Turbo-Drive" which has just recently been issued. Also included are sections describing proper flushing of turbine systems and features of Houghton's fortified turbine oil. Copies available.

Refractometer: Precision Scientific Co., 3737 W. Cortland St., Chicago 47, Ill.—In conjunction with Dow Chemical Company, the above company announces the development of a production control instrument, the Robomatic Refractometer. This new appliance has a wide scope of application in industry; it is claimed by the manufacturer that there is no similar apparatus on the market today and that its use in pilot plant operation can cause a savings of its own cost within six months. In in-

(*Continued on page* 39)

NEWS OF THE SECTIONS

BALTIMORE

This Section has completed a very successful Fall Season, having held four lecture meetings with a total attendance of one hundred and forty-six members and friends. Mr. John Boyd, Manager of the Lubrication Section of Westinghouse Research Laboratories in East Pittsburgh, Pennsylvania opened the Season in September with his presentation of "Principles of Lubrication," which was illustrated by models and colored motion pictures. Mr. Boyd's talk discussed the difference between the laws of dry friction and those of fluid friction and showed the manner in which fluid pressure may be built up in a slider bearing so that the sliding parts are completely separated by the lubricant. The principles were then extended to show their application to journal bearings and the thrust bearings for large water wheel generators.

In October, Mr. William H. Oldacre, President and General Manager of D. A. Stuart Oil Company in Chicago, Illinois presented a paper on "Fundamental Qualities and Limitations of Lubricants and their Relation to Machine Operation." Mr. Oldacre's talk very efficiently discussed and illustrated the fundamental principles of hydrodynamic lubrication and the scientific concept of polar orientation in boundary film lubrication. The current practices of lubrication were then appraised in the light of the current theories of lubrication and many valuable suggestions were offered for improved maintenance of machines and better metal working operations.

At the November Meeting, Dr. Dudley D. Fuller, Associate Professor in the Department of Mechanical Engineering of Columbia University in New York City, presented some new and novel practices of lubrication in his paper on "Solving Bearing Problems with Hydrostatic Lubrication." Dr. Fuller's talk was concerned with the application of the principle of hyrostatic lubrication to the solution of many kinds of bearing problems. The principle is a simple one and has a wide field of use, yet it is not very well known. Examples of the uses to which this kind of lubrication has already been put are: Floatation of Hale telescope at Mount Palomar; Suspension of torque measuring elements in many bearing testing machines; Oil lifts to enable large rotating units such as synchronous condensers to be started easily; Oil lifts to reduce wear at starting on turbines, motors, thrust bearings; Oil lifts to reduce friction and wear during operation of ball mills, rolling mills, etc.; Step bearings to carry heavy thrust with very high speeds (80,000 rpm) with very low friction; Oil cushions to support impulse loads without requiring a supply pump on flat surfaces or on curved surfaces such as journal bearings, or piston pins. Numerical examples were used to demonstrate the various applications which were in turn illustrated with slides.

In December, Mr. Robert E. Bright, Technical Representative from the New York Office of Dow Corning Corporation in Midland, Michigan presented a paper on "Silicone Fuids and Greases as Lubricants." Mr. Bright's talk, directed to that subject, included by way of background a very brief history of the development of the Silicones and their basic chemical structure, together with a resumé of the various forms in which silicone materials are produced and the properties common to silicones in all of their various forms. The bulk of the talk was devoted to a discussion of the properties of silicone fluids as lubricants and the properties of silicone greases, and the results of extensive test programs carried out by their grease laboratory in Midland, Michigan. The concluding portion of the talk covered various applications established for silicone oils in instruments, clocks, timing mechanisms, tenter frames and other special applications including their potential usefulness as impregnants for porous bronze bearings. Established uses for the silicone greases in the permanently sealed bearings of industrial motors, various types of textile machinery, recording and transcribing machines, cameras, and other instruments exposed to outdoor weathering including the results of comparative life testing in such bearings, constituted the final portion of the talk.

All of the above meetings were followed with highly spirited discussion periods which served to indicate the keen interest of those present in the specific subjects presented to us.

We are now eagerly looking forward to an active and successful Winter Season. Program for the balance of the season:

FEBRUARY 24

"Some Fringe Problems in Lubrication," by Alden Crankshaw, Eastern Service Manager, Acheson Colloids Corp., Port Huron, Michigan.

MARCH 24

"Developments in Gear Design and Their Lubrication Requirements," by L. J. Collins, Division Engineer, Gear Engineering Division, General Electric Company, West Lynn, Massachusetts.

APRIL 28

"Discussion on Packings and Lubrication Pertaining Thereto," by H. G. Koch, Member of the Research Staff, Johns-Manville Corporation, New York, N. Y.

Meeting Place—Sears Community House.

Time—8:00 P. M.

MAY 20

"Annual Business Meeting and Banquet"—place to be announced later.

We are indebted to Mr. Victor A. Ryan, Director of A. S. L. E. and Chairman of the Committee on Programs and Meetings for the Baltimore Section, for his excellent report.

CHICAGO

Mr. L. A. Danse of General Motors Corp. and a Director of A. S. L. E., spoke on "Lubrication Progress from Water Wheels to High Speed Machinery" at the November meeting. An evening with Mr. Danse is always informative as well as highly stimulating. Chicago inaugurated its first "Stump the Experts" program which has proved so successful in other Sections. It was no less so at this meeting and it is planned to repeat it in the future.

INDIANAPOLIS

At the November meeting, Mr. E. M. Glass, Headquarters Air Material Command, of Wright Field, Dayton, Ohio, gave a very interesting discourse on the "Principles of Lubrication Engineering as Applied to Aircraft Lubrication."

During the discussion, the audience was given a keener insight into the many lubrication problems facing the Air Force—problems other than those dealing directly with the lubrication of the aircraft engine itself.

The necessity and importance of the more or less recent developments in the field of Low Temp and High Temp Greases, and how these greases played an outstanding part in the Air Forces operations throughout the world, was brought out.

The importance of lubricants being able to withstand the most severe of climatic conditions, whether they be hot or cold, and still allow the various aircraft accessories such as machine guns, cameras, etc., to function with perfection was discussed.

A film was shown in conjunction with the discussion showing the activity at the all weather testing hangar at Eglin Field in Florida. The film rather vividly displayed the exhaustive test given a lubricant before Air Force approval was placed upon it for use in the various phases of aircraft lubrication.

Due to the holidays, no meeting was scheduled for the month of December.

PHILADELPHIA

Report from Secretary Eismann:

"The November meeting was highlighted by a discussion on "The Practical Significance and Interpretation of Testing and Laboratory Evaluation of Industrial Lubricants" by Mr. N. Bath of the Shell Oil Company. Mr. Milton A. Dewey of the DuPont Company assisted in the discussion. Since the scope of the subject was so great that it was impossible to cover all phases in one evening, Mr. Bath used the audience participation technique. In this way, those tests which were uppermost in the minds of members of the audience received the most attention. Mr. Bath and Mr. Dewey showed how the users of lubricants must rely more and more on the results of functional tests to distinguish between satisfactory and non-satisfactory lubricants. Members of the audience representing consumers pointed to the difficulties involved in attempting to run functional tests in their laboratories, since these tests very often require expensive equipment, lengthy test periods and highly trained laboratory technicians which they could not economically afford. At the same time, they often have very expensive equipment which must operate efficiently for long periods without shutdown in order to maintain plant efficiency. Representatives of the oil suppliers pointed out that many of the specifications put out by consumers were far too elastic in many instances to do much more than define the viscosity range of the lubricant. It was also pointed out that greases usually require more functional tests than oils where efforts are made to control quality by test methods."

EVANSVILLE

Our newest Section is now well under way with excellent plans for an interesting and successful season. Their January meeting augured well for the balance of the program. Mr. C. R. Schmitt, Manager of the Lubrication Department of E. F. Houghton & Company, delivered his always popular "Confused Lubrication." Mr. Schmitt is not only an excellent speaker but very well informed on his subject. The program tentatively selected has been arranged as follows:

February 8th—Subject: Development and Manufacture of Lubricants.

March 8th—Subject: Physical Properties of Lubricants.

April 12th—Subject: Greases: Their Characteristics and Manufacture.

May 8th—Speaker: Mr. C. L. Pope.

These meetings have been outlined to carry through related talks and give continuity to the entire series. We commend Mr. Clyde J. Winter, Program Chairman, as well as the other Officers for their hard work in putting over this new Section and assuring it of a successful growth.

BUFFALO

Queensway Hotel, St. Catherines, Ontario, Canada—December, 1949, meeting—Subject: "The Common Sense of Wire Rope" — Speaker: Mr. W. E. Brown, Chief Engineer, Wire Rope Division, B. Greening Wire Co., Ltd. Mr. Brown is well versed on his subject and from his wide experience, was able to satisfactorily reply to a lively question and answer period.

CLEVELAND-YOUNGSTOWN

The Director of Engineering of the E. W. Bliss Company, Mr. Jules Muller, was the speaker at the January meeting. Subject: "Press Lubrication and Maintenance." Mr. Muller illustrated his talk with informative slides showing various types of presses. Press parts that require lubrication were graphically illustrated. The next two functions of the Section will consist of:

February 28, 1950, meeting—Speaker: Dr. Sigmund Hammer, Gulf Research Laboratories, Pittsburgh, Pa. Subject: Geophysical Prospecting for Oil.

March 28, 1950, meeting—Speaker: Mr. John Simonds, Vickers, Inc., Detroit, Michigan. Subject: Practical Hydraulics.

Thank you to Mr. O. J. Riss, Secretary of this Section.

CONNECTICUT

Mr. Arthur F. Green, Secretary of the Connecticut Section, reports: "The December meeting of this Section was held on Wednesday, December 14th, at the Colonial House in Hamden, Conn., with 30 members and guests present. Mr. Anthony J. Zino, Jr., gave a very interesting and well worthwhile talk on "What to Look for in Hydraulic Oils." The January 25th meeting was held in New Britain, Conn. Mr. Charles R. Gillette, the Section's past Chairman, spoke on "Ball Bearing Lubrication."

DAYTON

Dr. E. S. Ross, Chemical Engineer of the Sun Oil Company, gave a very interesting talk on "Refrigeration Oils" at the October meeting. He prefaced this subject by pointing out the structural difference between the paraffin, naphthenic, and aromatic hydrocarbons. Further discussion covered the following:

1. Fundamental types of oil.
2. Type of oil depends on end use.
3. Use of naphthenic vs. parafinic oils.
4. Solubility vs. pour point.
5. Acid refining vs. solvent extraction.
6. Addition of oxidation inhibitors.
7. Possible use of synthetic oils.

In concluding his talk, Dr. Ross showed slides covering research and development work on rust and oxidation inhibited oils. Our thanks to Mr. H. L. Sellers, Dayton Section Secretary, for this report.

DETROIT

Because of a very successful meeting in April, 1949, when Mr. Anthony J. Zino, Jr., of Swan-Finch Oil Corp. spoke on "What to Look For in Hydraulic Fluids" and an interesting informal talk by Mr. M. A. Hayden, Asst. Sales Manager of Vickers, Inc., on this subject in January, 1949, these men combined the subject of Hydraulics at one meeting in November, which was highly stimulating. "Hydraulic Fluids" was ably covered by Mr. Zino and "Hydraulic Equipment" was discussed by Mr. Hayden. The Detroit people are progressing with their plans to act as hosts at the National Convention in April, which promises to be an outstanding event.

LOS ANGELES

In response to a number of requests for a paper on Diesels, this Section decided to hold a panel discussion on the subject, thus treating it in a broad and varied manner and meeting the needs of the greatest number. This program was given in November. In Chairman Engle's absence, Secretary Perso sent in this very excellent report. The meeting took the form of a round-table discussion, with a short introductory talk by Mr. Perso outlining the object of the meeting which was to take the form of questions and answers by those in attendance. "Mr. Ray Chester, Supt. of Diesel Generators, Southern California Edison Co., led off by giving an outline of his duties and the type of equipment he is in charge of, which includes the Vernon Power Plant, which was one of the largest of its kind when installed in 1932. (5—7,000 HP Hamilton engines) In the maintenance of slow speed, stationary diesel engines, few men, if any, possess a richer background. Mr. George Averill, Service Engineer of Cooper-Bessemer Corp., followed by giving a short talk on the operation of their engines in this area which consist of dual fuel units. This was extremely interesting since there are more of this type of units in the Los Angeles area than there are heavy duty diesels. Mr. Averill is an accepted authority on both the design and maintenance of the marine diesel. Mr. Leo Lofckie followed by discussing the matter of high speed diesel maintenance. Mr. Lofckie is very well qualified since he had a lot of practical experience with this type of unit in the Armed Forces and is now in charge of a fleet of diesel trucks, operated by the Harbor Box Company. The attendance was one of the largest for the year of 1949." Our thanks to "pinch-hitter" Perso.

PITTSBURGH

A "Stump the Experts" program took place in November, with the Board of Experts consisting of the following:

Mr. Charles L. Pope, of Eastman Kodak Co.

Mr. George L. Sumner of Westinghouse Electric Corp.

Dr. E. S. Carmichael of Socony-Vacuum Oil Co.

Mr. W. B. Shirk of Gulf Oil Corp.

Dr. E. M. Kipp of Aluminum Co. of America.

Dr. Edgar S. Ross of Sun Oil Co.

Mr. C. E. Pritchard of Republic Steel Corp.

Messrs. George H. Davis of Shell Oil Co., and Charles E. Trautman of Gulf Oil Co. were the judges. Mr. J. I. C. Taylor of Sun Oil Co. acted as moderator. Secretary Reynolds reports—"In spite of the wealth of experience and intelligence inherent in the Board of Experts, the local Section was required to pay out $3 for three questions which the "experts" were unable to answer. The consensus was that a highly successful evening was held." The Section was pleased to have President Pope in attendance to give the members and guests an overall picture of the Society and Section activities as well as a report of the two-day Lubrication Conference which was held in September at Kingsport, Tenn., sponsored by the University of Tennessee, for which the A.S.L.E. supplied speakers. The annual Christmas party took place in December with an excellent program and a large number of door prizes. This is always one of the popular events of the season.

MATTHEWS RETIRES

Ralph R. Matthews retired on December 31, 1949 as Executive Vice President of the Battenfeld Grease & Oil Corp., after 21 years of service with the company. He has achieved a distinguished reputation in the lubricating grease and oil industry. Mr. Matthews has held offices and served on Committees of numerous technical societies: ACS, ASTM, SAE, NLGI and API. He has been a member of ASLE since it was first organized. We are pleased that he is retaining his membership in our Society and plans active participation in the organization of our proposed Kansas City Section.

TWIN CITIES

Mr. Earl L. Niederloh, Industrial Sales Manager of Gray Company, Inc., Minneapolis, Minnesota, discussed "Lubricant Handling" at the December meeting. Mr. Niederloh talked on the ways and methods of handling lubricants and stressed the importance of applying clean lubricant to equipment. The usual question and answer period followed with much enthusiasm.

FORT WAYNE

An interesting report comes in from J. S. Michell, Secretary-Treasurer, and we quote: "With Mr. N. H. Schell, Fort Wayne Section Chairman, as host, one of the year's outstanding meetings was held at the Fort Wayne International Harvester Co. The dinner of roast turkey with all of the trimmings was thoroughly enjoyed by 50 members and guests. The lecture and discussion was ably handled by our good friend, Anthony J. Zino, Jr. Lubrication Engineer and Asst. Sales Manager, Industrial Division of the Swan-Finch Oil Corp. His talk on "Hydraulic Lubrication," in which he emphasized his points by use of slides, was very well received. The I.H.C. sponsored 13 guests including apprentice machine repairman, assistant foreman and apprentice instructor. The meeting was followed by a plant tour after which we viewed a moving picture on the development of the new Harvester truck."

The Fort Wayne Section is putting out a small mimeographed monthly booklet containing news of the personnel of their Section, plans for meetings, etc. Your editorial staff commend the enterprising idea and should any other Section desire further information on their "monthly publication," we suggest you write to one of the Fort Wayne Officers.

MILWAUKEE

A tour through the Globe Steel Tube Company plant preceded the dinner at the November meeting. The speaker of the evening was Mr. C. M. Finlayson of the National Lead Company who presented a talk on "Bentone Greases." This new development in lubricants was fully described, as well as what the company is doing to improve lubricants in general. The annual Christmas party and Monte Carlo night, with refreshments, games, food, prizes and fun, was carried off with their usual eclat, on December 19th. These affairs are always anticipated and thoroughly enjoyed by the Milwaukee group.

BALTIMORE SECTION ON RECORD

Soon after the First Annual Meeting of the American Society of Lubrication Engineers, which was held in Chicago in April of 1946, Mr. Paul F. Chappell began to pioneer the Baltimore area with the idea of organizing a local section and a special meeting was called on July 16, 1946 of all those interested in lubrication. Although the response was gratifying it was ascertained that there were not sufficient A.S.L.E. members to warrant application for a charter but that there was an immediate need for some group to sell National Society Memberships; so, the three musketeers of the Baltimore Section—Paul Chappel, Bob Cokinda, and Jay Trexler—set themselves to work and by the end of 1947 had obtained twenty memberships.

On January 27, 1948 an organization meeting was held with Mr. Oscar L. Maag, the then National President, presiding. A charter was granted and Baltimore became the 11th Section of the National Society. At this time a temporary chairman was named and a nominating committee chosen to select a slate of permanent officers, who were duly elected and installed on March 5, 1948 and the Baltimore Section began to function regularly. From this date to the Annual Meeting in May 1949, thirteen meetings were held with a total attendance of five hundred and twenty-two members and guests. During the interim, twenty-four new members were obtained — an increase of 120% in membership. Although the present roster is about equally divided between suppliers and consumers, the meetings usually run 70% or better of industrial lubrication engineers from industry in the Baltimore region.

The Baltimore Section embraces a district in which there are upwards of two thousand industrial plants some of which are the largest of their kind in the world. The leading industries include iron and steel products, aircraft, sugar refining, paper making, meat packing, chemicals, metal containers, shipbuilding, automobile assembly, men's clothing, petroleum refining, radios, wire cable, fertilizers, vegetable canning, bakery products, copper refining and stamped metal products.

Many companies such as Air Reduction, American Sugar Refining, Bendix Aviation, Consolidated Gas and Electric, Crown Cork & Seal, Davison Chemical, Glidden, Locke Insulator, Glenn L. Martin, Mutual Chemical, Revere Copper and Brass and Rustless Iron and Steel maintain large, well organized research laboratories. The field of Fundamental and Applied Scientific Research includes such institutions as the National Bureau of Standards, Washington, D. C., the Applied Physics Laboratory of Johns Hopkins University, Silver Spring, Md., the U. S. Naval Engineering Experimental Station at Annapolis and the American Oil Company's Dynamometer Laboratories in Baltimore.

The educational facilities are among the best in the country. Within a radius of forty miles are located some fourteen universities and colleges, nine of which are within the limits of the City of Baltimore. Among those either granting engineering degrees or offering pre-engineering courses are the Johns Hopkins University, Loyola College, the University of Maryland, Washington College, Western Maryland College and the U. S. Naval Academy.

Since its inception, the Baltimore Section has been carrying out the purposes of the National Society in advancing the knowledge and application of the art of lubrication by cooperation with industry and the professions. Its regular monthly presentation of papers cover all phases of lubrication and the problems relating to its application. The talks which have been given and those scheduled for the balance of the present season cover subjects of greatest mutual interest to industry, research and education.

The ultimate aim of this Section is to establish itself as an information center from which the industries and professions in and around Baltimore can obtain authoritative scientific and practical information on the various types of lubricants, methods of application, service performance, and proper procedures of lubrication engineering practice.

OUR COVER

Baltimore, metropolis of the Maryland "Free State," enjoys a strategic geographic location. It lies midway between the North and South, and is the closest Atlantic Seaboard city to the Middle West. A deep-water world port, it ranks high in all branches of foreign and domestic waterborne commerce, and is particularly well located to serve the growing maritime trade with Latin America and our own Pacific Coast. It was in the waters of Chesapeake Bay that the famous Baltimore Clipper of the American Revolution and War of 1812 days was developed. Its present Municipal Airport, situated at tidewater, has one of the country's finest seaplane terminals.

Diversity of manufacture is the distinguishing and vital feature of the city's industrial structure.

Founded in 1729, Baltimore is now in the third hundred years of her existence. This sweep of the centuries is important in understanding the city of today—sixth largest in the U. S. With the long background of tradition and experience, it is a matured and settled community. The wisdom of generations has taught her citizens that the twin aims of progress and security are possible only through intelligent effort linked with integrity and hard work. Due to its convenient location and varied community background, Baltimore annually is host to many large conventions sponsored by business, fraternal and cultural groups. The term "Maryland Free State" reflects the typical Baltimorean's insistence on personal liberty of action.

BARTH RETURNS

Edwin J. Barth, Petroleum Chemical Engineer, recently returned from Sweden where he acted as Consultant for Sweden's only refinery, A. Johnson & Company of Stockholm, for the past several years. He has now assumed the position of Director of Research and Development with the Alox Corporation, Niagara Falls, N. Y., manufacturers of petroleum derivatives and lubricating-oil compounds. Mr. Barth is a member of A.S.L.E., and we and his many friends welcome him back to the United States. We feel sure that his background and experience will be of great value to the Buffalo Section.

OILS AND LUBRICANTS PATENT ABSTRACTS

Process for Stabilizing Edible Fatty Oil—Patent #2,486,424—Frank A. Lindsey, Jr. and William F. Maxwell, assignors to The Southern Cotton Oil Co.

The process of stabilizing an edible fatty oil which comprises adding thereto a small proportion of substantially isolated citric acid and heating the mixture to within a range of 150 to 250°C. and continuing the heating for the time required, varying with the pressure and with the temperature within said range, to break down the citric acid into aconitic acid, aconitic anhydride, itaconic anhydride and citraconic anhydride, and arresting the process before decomposition proceeds beyond the formation of more than a minor amount of xeronic anhydride.

Oil Compositions—Patent #2,486,493—Anthony J. Revukas, assignor to Tidewater Associated Oil Co.

A mineral oil composition comprising a mineral oil having dissolved therein a small amount, sufficient to improve the lubricating characteristics of said oil while imparting to said oil an increased tendency to emulsify, of a polymerized ester of the acrylic acid series and a small amount, sufficient to reduce the increased emulsifying tendency imparted to said oil by said polymerized ester, of an oil soluble aliphatic ester of a phosphorus acid.

Grease—Patent #2,487,080—Reuben A. Swenson, assignor to Standard Oil Co.

A high-temperature grease comprising from about 30% to about 60% of an alkali metal soap of long chain fatty acids of at least about 12 carbon atoms, from about 1% to about 20% of an alkali metal soap of a preferentially oil-soluble sulfonic acid, from about 0.1% to about 10% of an alkali metal salt of a short chain aliphatic acid having not more than 6 carbon atoms in the chain, and a hydrocarbon oil.

Lubricant Composition—Patent #2,487,151 — Eugene Lieber and Aloysius F. Cashman, assignors to Standard Oil Development Co.

Composition consisting essentially of a major proportion of a waxy mineral lubricating oil and 0.5% to 2% of a co-condensation product of about 20 to 300 parts by weight of a chlorinated paraffin wax containing about 10% to 20% of chlorine, with about 100 parts by weight of a monobasic acyl chloride having at least about 8 carbon atoms, said condensation product having an average molecular weight of at least about 600 and being substantially non-volatile up to about 400°F. under a reduced pressure corresponding to an absolute pressure at least as low as about 20 mm. mercury, and said condensation product having been made by reaction of said two reactments at a temperature between the approximate limits of 400°F. and 700°F.

Diesel Fuel Oils—Patent #2,487.189—Herschel G. Smith, Troy L. Cantrell, and Mark L. Hill, assignors to Gulf Oil Corp.

An improved Diesel fuel oil which consists of Diesel fuel oil and from about 0.1% to about 0.25% by weight of the product obtained by neutralizing the mixture of fatty acids and alcohols contained in the hydrolized sperm oil with a long chain primary aliphatic amine that has at least ten carbon atoms.

Diesel Fuel Oils—Patent #2,487.190—Herschel G. Smith, Troy L. Cantrell, and Mark L. Hill, assignors to Gulf Oil Corp.

An improved Diesel fuel oil which consists of Diesel fuel oil and from about 0.01% to about 1.0% by weight of the products obtained by neutralizing with a long chain primary aliphatic amine having at least 10 carbon atoms the mixture of fatty acids, alcohols and sulfurized sperm oil obtained by partially hydrolyzing, from 10% to 50% by weight, a sulfurized sperm oil.

Extreme Pressure Lubricants—Patent #2,487.-260—Arnold J. Morway, assignor to Standard Oil Development Co.

A composition consisting essentially of:

	Per Cent
Acetylene Black	10
High modulus black	6
Lead oleate	10
Oil solution of polymer for imparting tackiness	1
Sulfurized fatty oil	10
Refined mineral oil of lubricating grade	63

Low Temperature Grease—Patent #2 487.261—John C. Zimmer and Arnold J. Morway, assignors to Standard Oil Development Co.

A lubricating grease composition consisting essentially of 80 to 90% by weight of mineral lubricating oil, 5 to 15% of channel black coated with mixed hydroxides of C_1 to C_2 alkyl silicon to facilitate dispersion in said oil, 3 to 10% of acetylene black, and 0.1 to 2% zinc naphthenate.

Treatment of Lubricating Oils—Patent #2.487.-306—Paul H. Carnell, assignor to Phillips Petroleum Co.

Printed copies of patents are available from the Patent Office at twenty-five cents each. Address the Commissioner of Patents, Washington, D. C., for copies and for general information concerning patents.

From Official Gazette—Vol. 628, Nos. 1, 2, 3, 4, 5; Vol. 629, Nos. 1, 2, 3, 4.

Prepared by ANN BURCHICK

The process of improving lubricating oil which comprises contacting said lubricating oil with substantially anhydrous liquid hydrofluoric acid in proportion sufficient to form a separate acid phase and with an added naphthene selected from a group consisting of cyclopentane, methylcyclopentane, cyclohexane, and methylcyclohexane in an amount ranging from 1.3 to 1.7 times the weight of said oil at elevated temperature of from 40 to 300°C. at a pressure sufficient to maintain the hydrofluoric acid and hydrocarbons in liquid phase for a period of time sufficient to produce a substantial increase in the viscosity index and stability of said lubricating oil, and recovering the treated lubricating oil from the resulting reaction mixture.

Lubricant — Patent #2,487,376 — Theodore G. Roehner and George W. Murray, assignors to Socony-Vacuum Oil Co., Inc.

A lubricating grease composition prepared from about 8.5 to about 48% of a fatty material, about 1.5 to about 7.5% of an alkaline material selected from the group consisting of alkali metal hydroxides and alkaline earth metal hydroxides, about 0.5 to about 15% of a water-dispersible polyvinyl alcohol, and the balance, mineral oil.

Lubricant — Patent #2,487,378 — Theodore G. Roehner and George W. Murray, assignors to Socony-Vacuum Oil Co., Inc.

A lubricating grease composition prepared from about 8.5 to about 48% of a fatty material, about 1.5 to about 7.5% of an alkaline material selected from the group consisting of alkali metal hydroxides and alkaline earth metal hydroxides, about 0.5 to about 15% of a water-dispersible phenol-formaldehyde resin, and the balance, mineral oil.

Lubricant — Patent #2,487,379 — Theodore G. Roehner and George W. Murray, assignors to Socony-Vacuum Oil Co., Inc.

A lubricating grease composition prepared from about 8.5 to about 48% of a fatty material, about 1.5 to about 7.5% of an alkaline material selected from the group consisting of alkali metal hydroxides and alkaline earth metal hydroxides, about 0.5 to about 15% of a water-dispersible natural gum, and mineral oil by heating together the fatty material, mineral oil, and a water solution of the natural gum, saponifying the resulting mixture with the aforementioned alkaline material and heating at a temperature within the approximate range 250-400°F. to yield a substantially anhydrous metal base grease.

Lubricating Composition—Patent #2,487,840—Paul R. Van Ess, assignor to Shell Development Co.

A lubricating oil composition of matter comprising a major amount of an oleaginous material and a minor amount, sufficient to stabilize said oleaginous material against deterioration and to improve its anti-wear properties, of a stable non-corrosive product of the group of a sulfur-containing and a metal salt of sulfur-containing reaction product obtained by reacting, at an elevated temperature of from about 130° to about 200°C., for from 2 to 8 hours, a cyclic ketone fraction having at least 12 carbon atoms with a non-phosphorus containing sulfurizing agent.

Heavy-Duty Industrial Grease—Patent #2.488,-293—Arnold J. Hoiberg, assignor to Lion Oil Co.

A lubricating grease consisting essentially of a blend of an air-blown asphaltic product with from 15 to 70% of a petroleum fraction having at least the boiling point of gas oil, said asphaltic product being air-blown from a base petroleum residuum of greater than 375°F. flash point in the presence of a small quantity of a catalytic agent which acts to lower the penetration-temperature susceptibility, the air-blown base having a softening point within the range of 230° to 350°F. and a PTS within the range of 0.005 to 0.015.

Process for Resolving Petroleum Emulsions—Patent #2,488,593—John L. Harlan, assignor, by mesne assignments, to Standard Oil Development Co.

A process for breaking a petroleum emulsion of the water-in-oil type which comprises subjecting the emulsion to the action of a treating agent comprising a petroleum sulphonic acid body having a nitro group attached to the hydrocarbon nucleus thereof.

Lubricants of the Extreme Pressure Type—Patent #2,488,618 — Elmer B. Cyphers and George M. McNulty, assignors to Standard Oil Development Co.

A composition consisting essentially of 80 to 99.5% of petroleum base lubricating oil and 0.5 to 20% of the phosphorus-containing reaction product of a sulfide of phosphorus with a methyl ester of abietic acid which has been substantially saturated with a material selected from the class which consists of hydrogen and sulfur, said reactant ester and sulfide of phosphorus being reacted for a substantial period of time at a temperature between about 60°F. and about 300°F.

Lubricant — Patent #2,489,249 — David E. Adelson, assignor to Shell Development Co.

A lubricant comprising a major amount of a mineral lubricating oil and a minor amount, sufficient to stabilize said oil against oxidation and corrosion deterioration, of a reaction product obtained by first reacting an organic compound with hydrogen sulfide and ammonium hydrosulfide at room temperature and treating the resulting reaction product with an inorganic compound selected from the group consisting of phosphorus sulfide, sulfur halide, elemental sulfur and alkali polysulfide at a temperature of at least 150°C.

Methacrylates in Constant Viscosity Oils—Patent #2,489,281—Edward G. Foehr, assignor to California Research Corp.

A normally liquid composition of lubricating oil viscosity having superior viscosity-temperature characteristics consisting essentially of, by weight, about 2 to 8 parts of a high molecular weight oil-soluble polymer of a material selected from the group consisting of alkyl esters of acrylic acid and alkyl esters of homologues of acrylic acid, the alkyl radical of said alkyl esters containing at least 4 carbon atoms, and said polymer being miscible in all proportions with light mineral oils of viscosities between 30 and 500 SSU/100°F.; about 3 to 6 parts of an oil-soluble soap of acid material selected from the group consisting of high molecular weight fatty acids and naphthenic acids, and a polyvalent metal selected from the group consisting of aluminum and magnesium; and sufficient hydrocarbon lubricating oil having a viscosity ranging from about 30 to about 110 SSU/100°F. to make 100 parts of composition.

Lubricants and the Like—Patent #2,489,300—Frank A. Leyda, assignor to California Research Corp.

A normally liquid composition of lubricating viscosity having superior viscosity-temperature characteristics, which consists essentially by weight of about 85 to 99% of a hydrocarbon lubricating oil; about 0.5 to 6% of a thermoplastic polymeric material dispersed in said lubricating oil, said thermoplastic material having recurring polar groups and being substantially insoluble in the lubricating oil at normal atmospheric temperatures; and about 0.5 to 6% as dispersing agent of an oil-soluble soap material selected from the group consisting of aluminum and magnesium soaps and mixtures thereof.

Lubricating Oils and the Like—Patent #2,489,-301—Edward G. Foehr and Frank A. Leyda, assignors to California Research Corp.

A normally liquid composition of lubricating viscosity consisting essentially by weight of about 65 to 94% of a hydrocarbon lubricating oil; about 0.5 to 6% of a high molecular weight thermoplastic material dispersed in said lubricating oil, said thermoplastic material having recurring oxygen-containing polar groups and being substantially insoluble in the lubricating oil at normal atmospheric temperatures; about 0.5 to 6% as dispersing agent of an oil-soluble, polyvalent metal soap of a fatty acid to maintain the polymeric material dispersed in the lubricating oil, and about 5 to 20% of an oxygen-containing polar solvent solubilizing agent for the polymeric material, said polar solvent being miscible with the lubricating oil.

Lubricants—Patent #2,490,068—Bert H. Lincoln and Joseph M. Hersh, assignors to Continental Oil Co.

A lubricating oil comprising a major proportion of an oil of lubricating viscosity and 0.0001% to 10% of a di-ester of azelaic acid, the terminal carboxyl groups of which are substituted with at least one diphenyl silicon containing chemical group.

Rust-Preventing Composition—Patent #2,490.-264—John D. Garber, assignor to Standard Oil Development Co.

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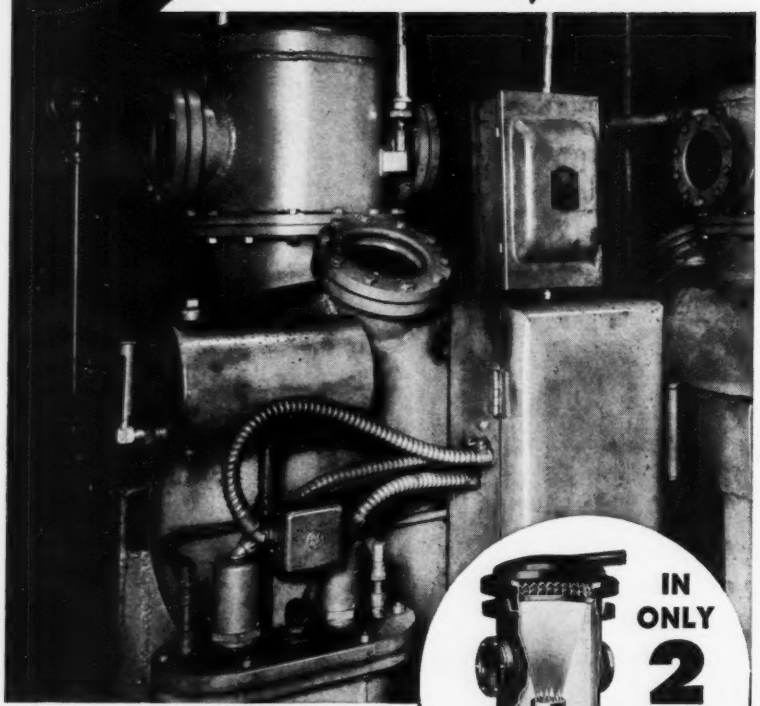

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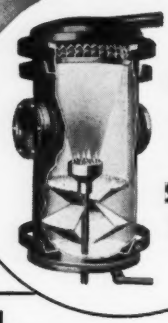

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Lubricating Grease—Patent #2,491,054—Arnold J. Morway, assignor to Standard Oil Development Co.

A lubricating composition consisting essentially of a lubricating liquid comprising 20 to 90% by weight, based on said liquid of a dibasic acid ester, said liquid being thickened to a grease-like consistency by the use of 3 to 35% by weight, based on the total composition, of a metal soap of a fatty acid, and about 5 to 25% of a copolymer of styrene and isobutylene having a styrene content of 40 to 60% by weight, an intrinsic viscosity of at least 0.6 and a molecular weight between 1000 and 100,000.

Grease Compositions — Patent #2,491,055 — Arnold J. Morway and David W. Young, assignors to Standard Oil Development Co.

A lubricating grease composition consisting essentially of a major proportion of lubricating oil, about 3 to 30% by weight of a metal soap of a fatty acid, about 0.1 to 5.0% by weight, based on the total composition, of a high molecular weight copolymer of about 40 to 65% by weight of a polymerizable mono-olefinic compound having a cyclic nucleus, and about 60 to 35% of an aliphatic olefin of 3 to 8 carbon atoms, said copolymer having an intrinsic viscosity greater than 0.5, said grease also containing about .01% to 3% by weight of an aliphatic linear polymer stringiness agent having an average molecular weight of at least 30,000.

Rust Inhibitor for Mineral Oils — Patent #2,491,066—Jones I. Wasson and Gordon W. Duncan, assignors to Standard Oil Development Co.

A coating composition consisting of at least 88% by weight of a petroleum vehicle, a quantity of oil-soluble petroleum sulfonate rust inhibitor sufficient to inhibit rusting of ferrous metals under average normal atmospheric conditions, and an activator for said inhibitor, said activator being an oil-soluble C_{10} to C_{30} alkylated acidic material having two separate polar groups of which one is a terminal carboxyl group and said carboxyl group being separated by at least one and not more than four carbon atoms from a second polar group selected from the class which consists of thio and carboxyl radicals.

Stabilized Lubricant—Patent #2,491,432—Ellis Ross White, assignor to Shell Development Co.

A fluid lubricating composition comprising as the major lubricant therein a fluid selected from the group consisting of polyalkylene oxide fluids, polyalkylene glycol fluids and poly (alkylene oxide-alkylene sulfide) fluids, and 0.5-5% by weight of 1,2-dihydroxybenzene.

Water Resisting Grease—Patent #2,491,441—Richard A. Butcosk and Ernest T. White, assignors to Socony-Vacuum Oil Co., Inc.

A grease composition of increased water resistivity comprising a major proportion of a mineral lubricating oil, from about 10% to about 30% of metal soaps of fatty acids, sufficient to impart the desired grease body, and in addition thereto a small amount from about 0.2% to about 6.0% by weight of a resinate of a divalent metal selected from the group consisting of zinc, cadmium, calcium and magnesium.

Synthetic Drying Oils—Patent #2,491,496—Warren W. Johnstone, assignor to Universal Oil Products Co.

A drying oil having a boiling range of from about 150° to about 400°C., a density of from about 0.83 to about 0.93, an index of fraction of from about 1.47 to about 1.53, a bromine number above about 140, a maleic anhydride value of from about 50 to about 80, an average of from about 2.5 to about 3.5 double bonds per molecule, and a molecular weight of from about 150 to about 1000 formed by reacting an olefinic hydrocarbon fraction with liquid hydrogen fluoride, and recovering the drying oil from the hydrofluoric acid layer.

Production of an Aluminum Base Grease Containing Organic Amines—Patent #2,491,641—Arnold A. Bondi, assignor, by mesne assignments, to Shell Development Co.

The method comprising forming an aluminum soap grease from a mixture of a mineral oil base having a viscosity of less than 2000 SSU at 100°F., up to 6% of aluminum monostearate, and 0.05% to 0.3% of a saturated aliphatic amine having 5 to 36 carbon atoms per molecule, feeding the grease in hot fluid condition to a heat-conductive moving surface, forming a thin layer of the grease thereon, and cooling the grease while in a quiescent state by subjecting the grease to the action of a gaseous heat-absorbing medium until there is produced a smooth substantially homogeneous grease gel.

(*Continued on page* 37)

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EFFECTIVENESS OF MIST LUBRICATING AND COOLING SYSTEMS

(*Continued from page* 22)

Disadvantages and costly errors, traceable to surface grinding dry or with conventional cooling systems can be eliminated by using a recently-developed cool-grinding attachment. Primarily, wet grinding in this case is practically dry grinding so there are no guards, messy tanks and other undesirables. No change in present grinding wheel selection is necessary. However, a special coolant and wheel guard cover must be used. The system, or attachment, basically consists of only three parts:—a reservoir, mounted on top of the spindle housing, which holds one gallon of coolant and enough for eight hours of operation; two sight drip flow regulating valves and a solid wheel adapter. The assembly functions as follows:

The flow of coolant which is but a few drops per second is governed by the needle valves designed for fine adjustment. The coolant flows by gravity through flexible tubes fitted to the special wheel guard cover, then into the V-groove collector ring. This receiving ring is a part of the nut that holds the wheel on the spindle. The coolant then passes through holes into the grinding wheel and is in turn flung by centrifugal force through the wheel pores and then to both cutting edges of the wheel face.

It is apparent that with the new system, the coolant is applied directly at the point of contact of the wheel and work and at the instant of grinding, whereas conventionally the coolant arrives at the work just behind the cut. Tests on steel, varying in hardness, show from 100 to 400 degrees lower temperatures, generated by the so-called "cool" grinding system. It seems that this rapid heat dissipating technique should solve a major part of the everlasting tool room problems relative to wheel cracks, skin hardness and warpage attributed to sudden rise in temperature followed by sudden shock quench.

The conventional system is particularly determined by the extent to which the original properties of the coolant will be affected by continuous recirculation. With the new system, every drop of coolant turned into a fine mist is clean and the constant flushing action automatically keeps the surface of the wheel free of broken grits and grinds. The results are, definitely improved finish with less time and longer wheel life by extending periods between dressings.

Patent Abstracts

(*Continued from page* 34)

Lubricant Composition — Patent #2,491,649—Gordon W. Duncan and John C. Zimmer, assignors to Standard Oil Development Co.

A composition of matter consisting essentially of a major amount of a mineral lubricating oil and 0.02 to 10% by weight based on the total composition of the reaction product of at least one molecular proportion of a metal salt of preferentially oil-soluble petroleum oil sulfonic acid with one molar proportion of a metal polysulfide selected from the alkali and alkaline earth metal polysulfides, said reaction product being prepared by mixing together a concentrate in mineral oil of said first named metal compound and an aqueous solution of said polysulfide and heating the mixture to a temperature ranging between 250° and 325°F. to complete said reaction and drive off water.

Lubricant Composition — Patent #2,491,683—John C. Munday and Dilworth T. Rogers, assignors to Standard Oil Development Co.

A lubricating oil composition consisting essentially of a major proportion of waxy mineral lubricating oil, having dissolved therein about 0.07 to 0.20% of a wax naphthalene pour depressor having a molecular weight of about 1500 to 3000, consisting essentially of a Friedel-Crafts condensation product of about 100 parts by weight of chlorinated paraffin wax having a chlorine content of about 12 to 15% with about 15 parts by weight of naphthalene, said condensation product being substantially non-volatile up to about 600°F. under fire and steam distillation, and said lubricating composition also containing dissolved therein about 0.05 to 0.25% of a polyfumarate having a molecular weight from about 1000 to about 5000 and consisting essentially of a polymerization product of fumaric acid esters of the mixed alcohols contained by hydrogenation of coconut oil, the concentration of the wax-naphthalene condensation product being about 0.5 to 2.0 parts by weight to 1 part by weight of the polyfumarate.

Extreme Pressure Lubricants—Patent #2,491,772—Harry W. Rudel, assignor to Standard Oil Development Co.

An extreme pressure lubricant composition comprising a major proportion of highly refined mineral lubricating oil and 2 to 30% by weight, based on the total composition, of the reaction product of an alkali metal salt of a hydrocarbon substituted dithiocarbamic acid with a chlorinated hydrocarbon, said reaction product having the formula

XCSSEster

where X is a radical selected from the group consisting of dialkyl amines, monoalkylaryl amines, and the piperidine radical, the ester-forming group being a chlorinated petroleum hydrocarbon radical of 8 to 30 carbon atoms containing at least 5% and not more than 50% by weight of chlorine.

Penetrating Oils — Patent #2,491,774—Henry E. Schulz.

A penetrating oil comprising a mixture of 75% to 99.75% by weight of citrus peel oil and 0.25% to 25% of a lubricant of the group consisting of paraffin, liquid petroleum oil and castor oil.

Lubricating Oil Composition—Patent #2,492,789—Hector C. Evans and David W. Young, assignors, by mesne assignments, to Jasco, Inc.

A lubricating oil composition comprising a hydrocarbon lubricating oil blended with about 3% by weight of polybutene having a molecular weight of about 12,000, a substantially equal amount of a polyacrylate having a molecular weight of about 17,000, and with about 12% by weight of dibutoxy ethyl phthalate.

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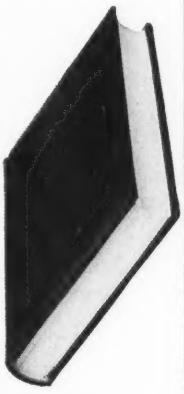

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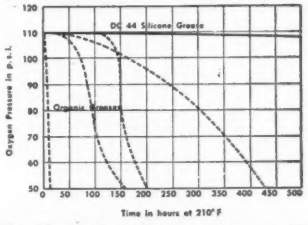

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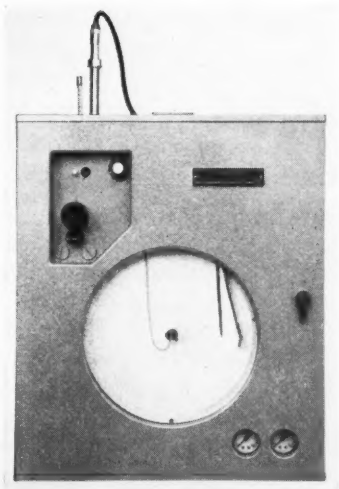
NEW PRODUCTS AND EQUIPMENT

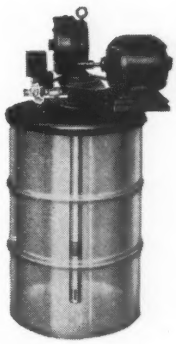
(*Continued from page* 28)

dustrial use its cost will be absorbed in less time. Application is found in any industry where liquids which are clear enough to provide a refractive index are produced or combined. It covers the entire range of refractive indices from 1.32539 to 1.54409. It is said to control over the entire range to within three parts in the fifth decimal place, thereby eliminating human error in controlling process pipe lines. Some of the applications recommended are plastics, synthetic rubber, petroleum products, ammonia, pharmaceuticals, and all aqueous and alcoholic solutions not having suspended solids. The instrument comprises a dipping refractometer, a constant temperature bath with a range from 35°F to 150°F, accurate within 0.02°, a recorder actuated by a photoelectric cell and amplifier, and an air operated controller.



Oil Cup and Gauge: Trico Fuse Mfg. Co., 2948 N. 5th St., Milwaukee 12, Wis.—Trico Bulletin No. 31 describes a new dual purpose unit embodying a visible oil cup and a visible oil gauge conveniently constructed for checking oil levels periodically, and is said to be easily and quickly installed. Free copies available.

Rochester Tech: Rochester Institute of Technology, 65 Plymouth Ave., South, Rochester 8, N. Y.—A five-day course will open February 20th under the direction of Edward W. Goebel, head of the R.I.T. Screw Machine Laboratory. The program will be conducted on the basis of two 2½-day conferences. The course was originally designed for experienced screw machine personnel and will emphasize advanced technology utilized to obtain increased efficiency and lower costs. Application for registration should be made direct to the Institute, attention Alfred L. Davis.



Drum Pump: Lincoln Engineering Co., 5743 Natural Bridge Ave., St. Louis 20, Mo.—Announcing a new Centro-Matic drum pump, model 1837, for use with original lubricant drums. Fully automatic, time clock controlled, and designed for use with Centro-Matic lubrication systems where compressed air is not available. Standard equipment includes control panel with time clock, pressure switch, and signal alarm. It is said by the manufacturer to pump with equal facility heavy, viscous or fluid lubricants. Write for bulletin 800-1.

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Current Literature

(*Continued from page 27*)

THE ROLE OF ADSORPTION FROM SOLUTION IN CORROSION INHIBITOR ACTION
Hackerman, N. and Schmidt, H. R.—pp. 237-243

The paper was presented at the University Conference on Corrosion and Material Protection, in Chicago, Illinois, in June, 1947. The use of polar organic substances and colloidal materials as corrosion inhibitors has been investigated for many years and wide application has been found for them, especially in acid solutions. The materials function essentially by treating the metal surface, and the authors discuss the part played by adsorption from solution in the mechanism of their action. A generalized theory for the mechanism of organic corrosion inhibitors, and experimental investigations are covered.

HIGH TEMPERATURE GREASES
McConville, H. A.—p. 9
(Product Eng., Vol. 19, No. 1, Jan., 1948—pp. 93-95)

Factors to consider when selecting and applying greases for high temperature service include stiffness, dropping point, acidity, evaporation, effect of different metals on oxidation, and operating speed. Rate of oxidation of a grease that is in contact with bearings fitted with bronze retainers is three to four times that of ordinary steel. Ordinary naval brass and aluminum bronze speed oxidation; stainless and rustless steels are somewhat better. One of the most stable surfaces is chromium plate.

HIGH TEMPERATURE CORROSION OF METALS
Dravnieks, A. and McDonald, H. J.—pp. 227-233

The paper was presented at the Fifth Annual Conference, National Association of Corrosion Engineers, in Cincinnati, Ohio, April 11-14, 1949. With the development of new forms of primary machines such as gas turbines and jet propulsion motors, the interest of many metallurgists have been focused on heat-resistant metals and alloys. A search is going on for materials which retain their good mechanical properties at high temperatures and possess good resistance against chemical attack by gases. This paper deals with problems concerning this form of chemical attack and presents some general ideas and new developments in the field. Fifty-two references are given.

Vol. 5, No. 9, September, 1949

NEW DEVELOPMENTS IN PROTECTIVE COATINGS
Tator, K.—p. XV

Four classes of tools are employed by the corrosion engineer: Corrosion-resistant metals, cathodic protection, corrosion inhibitors, and protective coatings and linings. The latter is the field of Technical Practice Committee No. 6—Protective Coatings. While this committee has been in existence for a number of years, prior to April, 1949, its activity was that of reference and co-ordination. On that date new objectives were established. Protective coatings and linings may be defined as continuous inert barriers interposed between the load-bearing corrodable metal and the corrosive environment. Passive protective films formed by inhibitors or other causes fail through lack of inertness to fall within this definition. Protective organic coatings and linings range from the relatively thin paint films to heavy duty sheet linings. The NACE

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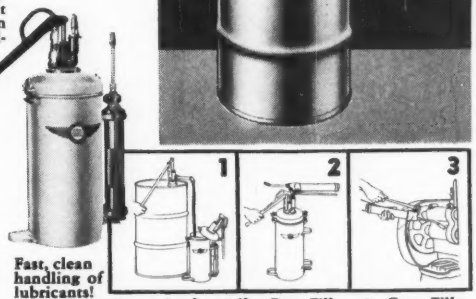

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through Technical Practice Committee No. 6 has embarked into a new fast-growing field, which is neither served nor represented by any other organization. This is the field of coatings for resistance to aggravated or severe corrosion attack such as chemically active corrodents, sustained galvanic corrosion, or corrosion accompanied by abrasion, erosion, or impact. Sub-Committee 6A—Organic Coatings and Linings for Resistance to Chemical Corrosion, Kenneth Tator, Chairman, is functioning to provide reliable performance data on each of the organic materials now in successful use.

CORROSION RESISTANCE OF SPRAYED METAL COATINGS
Meyer, W. B.—pp. 282-287

CORROSION INHIBITORS
Sussex, A. G.—p. 30
(Australasian Engr., 1947—pp. 68-75)

A review of the mechanism of corrosion inhibition, which views this essentially as polarization of anodic or cathodic areas by the inhibiting substance. Various systems are discussed. Vapor-phase inhibitors are mentioned and specifically morpholine nitrite and 2-amino-butane nitrite. The following topics are touched on: the effect of arsenic in repressing dezincification of brass, surface-active substances as corrosion inhibitors and undesirable effects arising from their use, and the nature of the surface film formed on iron which has been inhibited by chromates. A bibliography is given.

A METHOD FOR ACTIVATING STAINLESS STEEL SPECIMENS PRIOR TO CORROSION TESTS
Bayer, R. O. and Kachik, E. A.—pp. 308-310

Everyone who has run corrosion tests on the austenitic stainless steels has encountered conditions under which a specimen will corrode at a rapid rate during one or more periods of the test, but will corrode negligibly or not at all during the other periods. Common practice has been to expose as-ground or as-polished specimens to the testing solution and observe their performance. Frequently this procedure gives unsatisfactory results. Apparently the as-ground specimens that do not corrode are passive when introduced into the test solution, while those that do corrode are active when introduced. An alternative procedure is to insure that all specimens are active when exposed to the testing solution, and then to observe whether they become passive during exposure and, if not, how severely they corrode. A method for providing initial activation of the specimen in corrosion tests has been worked out and used in this laboratory with consistent success on stainless alloys under a wide variety of corrosive conditions. This method involves pickling the specimen immediately prior to its introduction into the corrosion-test medium.

SINCLAIR RUST INHIBITOR
Anon.—p. 30
(Machinery, Vol. 55, No. 2, Oct., 1948—p. 232)

RD-119, a rust inhibitor for gasoline and fuel oil lines. Manufactured by Sinclair Refining Co.

THE USE OF INHIBITORS FOR CONTROLLING METAL CORROSION. PART I GENERAL PRINCIPLES
Colegate, G. T.—p. 32
(Metallurgia, Vol. 39, No. 229, Nov., 1948—pp. 18-20)

In this first article of a series author deals with types of corrosion and classifies the various inhibitors in use into groups.

Diesel Progress, Vol. 15, No. 6, June, 1949

RE-REFINED LUBRICATING OILS RE-USED IN DIESEL ENGINES
Anon.—p. 66

Operators of stationary or mobile Diesel power units who use 50 to 75 or more gallons of lubricating oil weekly are offered an automatic machine for re-refining the oil after it has done a cycle of duty in the crankcase. The equipment, manufactured by Automatic Oil Refiners, Inc., uses a catalytic process with high temperatures and sub-atmospheric pressures together with complete filtration. It performs a complete re-refining process on used lubricating oils, rendering them ready for re-use at quality levels equal to or better than the original oil, according to the manufacturer.

Vol. 15, No. 8, August, 1949

FUEL OIL FILTERS AND SEPARATORS
Anon.—p. 48

The present line of basket separators and fuel oil filters designed and manufactured by the Kraissl Company, Inc., is taken up. The advantages of the design are stressed.

PATTERN FOR PREVENTATIVE MAINTENANCE
Smith, H. G.—pp. 52, 54

The various problems involved in the maintenance of engines or machines are divided into twelve groups, and each of the twelve major groups is discussed separately.

Vol. 15, No. 9, September, 1949

FREE PISTON GAS GENERATOR BRIGHTENS GAS TURBINE FUTURE
Small, L. F.—pp. 30-32

The paper was presented before the SAE summer meeting at French Lick in June, 1949. The construction and operation of a Pescara Gasifier or Free Piston Gas Generator is described. The Gasifier consists of a highly supercharged Diesel cylinder, all of the power of which is used to compress the atmospheric air required for scavenging the charging of this cylinder. The construction of the gasifier-turbine combination, which is discussed, promises to open the most efficient way of producing power and potentially the most compact and light plant.

TEST STAND FOR FUEL INJECTOR PUMPS
Robison, D.—p. 33

The design of the test stand for fuel injector pumps is described. The first crude stand merely measured the amount of fuel injected into one cylinder but development has produced precise equipment that not only measures the fuel injected into as many as eight cylinders simultaneously, but also checks governor operation, makes it possible to set minimum and maximum speeds before the pump is installed on the engine, checks for leaks and shows pressures. All of these tests and adjustments are performed while the test part is mounted on the stand.

A NEW, COMPACT, POWERFUL DIESEL
Young, W. W.—pp. 34-35

The new heavy-duty Diesel engine, the LSV-16, rated 3400 horsepower, at 327 revolutions per minute, can be operated as either an oil or gas burning Diesel or a spark ignition engine. Conversion for any of these three types of operation is accomplished without changing the cylinder heads or pistons. The design of the engine is described.

IMPROVEMENTS ON DUAL FUEL ENGINES
Anon.—pp. 28-29

Described in this article are two improvements on dual fuel engines. These are the new Dual Plunger Fuel Pump and the Automatic Thermal Air Control which provide greater efficiency and smoother operation over a wide load range in dual fuel Diesels. The design and operation of the dual plunger fuel pump, automatic thermal air control, thermal throttling control and control setting are described.

DIESEL FUEL FROM OIL SHALE
Anon.—pp. 42-43

The Bureau of Mines Oil-Shale Demonstration Plant at Rifle, Colo., and its operation aiming at the production of Diesel and other liquid fuels from oil-shale at economic levels are taken up. A flow diagram of the experimental shale-oil refinery showing the production of Diesel fuel, is presented.

***Erdol und Kohle*, Vol. 2, No. 6, June, 1949**

OXIDATION BEHAVIOR OF HYDROCARBONS. V. OXIDATION OF SYNTHETIC LUBRICATING OILS
Kroger, C. and Kaller, A.—pp. 240-245

Vol. 2, No. 10, October, 1949

COLD VISCOSITY OF LUBRICATING OILS
Hennenhöfer, J.—pp. 450-456

Lubricating oils pass from the liquid to the solid state when sufficiently cooled. Using the usual test methods, the viscosity seems to depend on the mechanical treatment of the oil before determination

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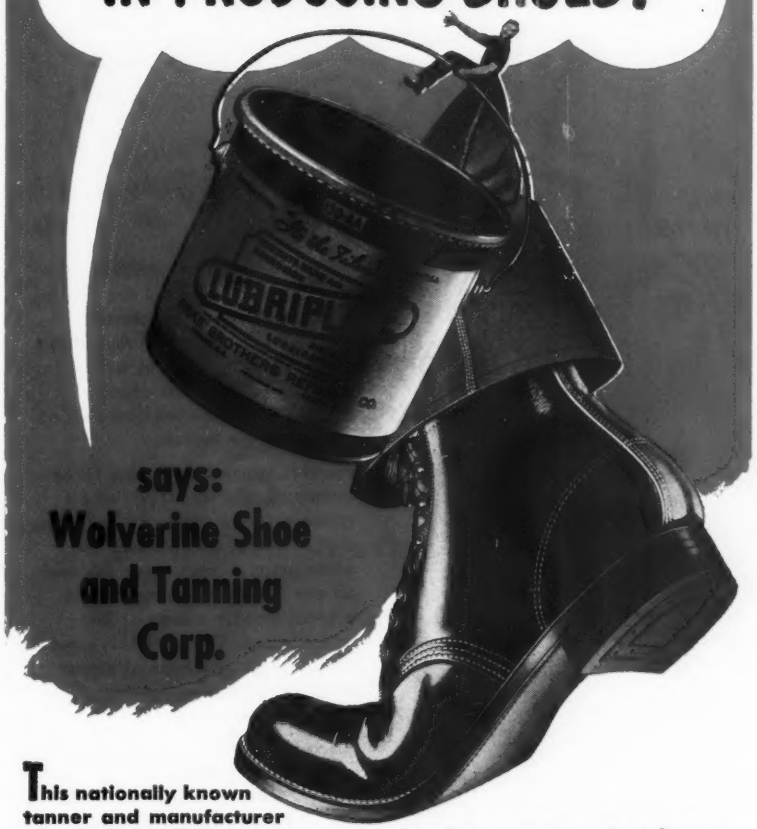

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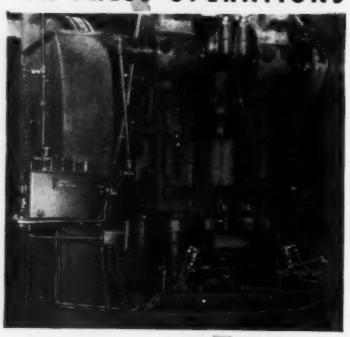

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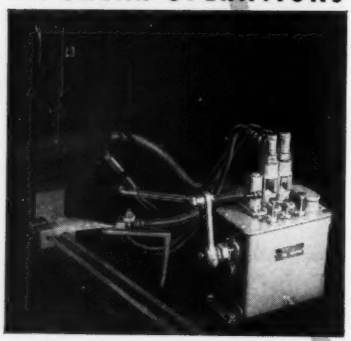

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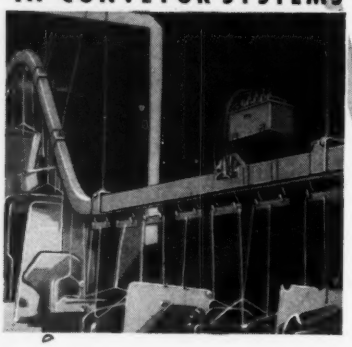

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and on the shearing stress, resistance to flow, the dimensions of the viscometer (diameter, length of measuring capillary) and on the previous thermal history of the oil. These undesirable effects are eliminated by the test method described by the author. The influence of the shearing stress is eliminated if the test method is worked out according to the Bingham friction law, that is by setting up the flow behaviour outside the viscosity, considering the flow limit as second material constant. The uniform setting up of the flow behaviour by using the Bingham law, however, is applicable only for measurements with the same viscometer, because the diameter of the measuring capillary also has an influence. This effect was studied for various oil samples. There is a relationship between the pourpoint and the resistance to flow, if the oils at the pourpoint still flow as Newtonian liquids.

LABORATORY INVESTIGATION ON EXTINGUISHING OIL FIRES WITH AIR FOAM
Daimler, K.—pp. 457-8

Foam is much more effective in putting out fires of oil than sprayed water.

Fuel (Formerly Fuel In Science and Practice), Vol. XXVII, No. 2, May-June, 1948

PRODUCTION OF OLEFINS BY THE CRACKING OF FISCHER-TROPSCH WAXES AND THEIR CONVERSION INTO LUBRICATING OILS
Dazely, G. H., and Hall, C. C.—pp. 50-55

The total waxes produced at atmospheric and ten atmospheres pressure by synthesis from hydrogen and carbon monoxide in the presence of a cobalt catalyst have been subjected to a non-catalytic vapor-phase cracking at temperatures in the range 500° to 640°C. The yields, composition and properties of the products have been determined and a comparison made with the products from the cracking of Diesel oil. Polymerization of the olefins gives greater yields of lubricating oil with a high viscosity index than are obtained from the products of cracking the Diesel oil fraction, because of the greater production of long-chain olefins from the waxes. From the higher oxidation numbers for the oils it is concluded that the low oxidation number previously found for oils from the higher boiling fractions of cracked Diesel oil is not to be attributed solely to the long chain-length of the olefins present in these fractions.

Fuel Abstracts, Vol. 5, No. 4, April, 1949

FUTURE OF PETROLEUM FUELS #2830
Oriel, J. A.—p. 61
(Pap. to Oil Industr. Club; abstr. in Petrol. Press Serv., Vol. 15, Nov., 1948—pp. 255—256)

BOUNDARY LUBRICATION: REVIEW OF RECENT PROGRESS #2838
Clayton, D.—p. 62
(Brit. Sci. News, Vol. 2, No. 14, 1948—pp. 35-37)

ADDITION AGENTS IN LUBRICANTS #2839
Girelli, A.—p. 62
(La Rivista dei Combustibili, Vol. 2, Oct., 1948—pp. 245-254)

EFFECT OF DETERGENT ADDITIVES ON DISPERSING PROPERTIES OF OILS #2842
Krein, S. E., Lipshstein, P. A. and Alexandrov, A. N.—p. 63
(Neft. Khoz., No. 6, 1948—pp. 43-50)

SYNTHETIC FATTY ACIDS FROM PARAFFIN #2932
Salvi, G.—pp. 83-84
(La Rivista dei Combustibili, Vol. 2, Oct., 1948—pp. 221-230)

SYSTEMATIC SAMPLING #3289
Yates, F.—pp. 159-160
(Phil. Trans. Roy. Soc., Vol. 241, 1948—p. 345)

LONG-TERM TESTING OF TRANSFORMER OIL #3305
Elgenberg, A.—p. 163
(Tekn. Tidskr., Vol. 78, Oct. 2, 1948—pp. 630-634)

DETERGENT OILS FOR HIGH SPEED OIL ENGINES #3059
Wilford, A. T.—pp. 111-112
(Gas Oil Pwr., Vol. 43, 1948—pp. 233-235)

ENGINE PERFORMANCE OF LUBRICANTS #3060
Williams, C. C.—p. 112
(Pap. to Northern Branch Inst. Petrol.; in Inst. Petrol. Rev., Vol. 2, Oct., 1948—pp. 306-316)

PUROLATOR OIL FILTER #3061
Anon.—p. 112
(Gas Oil Pwr., Vol. 43, Oct., 1948—p. 307)

AIR AND OIL FILTRATION #3062
Anon.—p. 112
(Auto. Engr., Vol. 39, 1948—p. 12)

NEW FORM OF VISCOMETER FOR TRANSPARENT VISCOUS LIQUIDS #3340
Elkarim, A. A.—p. 170
(Rev. Sci. Instrum., Vol. 19, Dec., 1948—pp. 833-834)

GERMAN VISCOMETRY—NEW APPARATUS FOR VERY HEAVY LIQUIDS #3342
Willenberg, H. and Fritz, W.—p. 170
(Angew. Chem., Vol. B20, 1948—pp. 134-139)

Gas Abstracts, Vol. 5, No. 7, July, 1949

REVIEW OF INFRA-RED SPECTROSCOPY IN ANALYTICAL CHEMISTRY
Crooper, F. R. and Hamer, A. A.—p. 168
(Anal. Chimica Acta, Vol. 3, March, 1949—pp. 169-179)

INFRA-RED ABSORPTION ANALYSIS USED IN CONTROL OF A PILOT-PLANT PROCESS
Fry, D. L.—pp. 166-7
(J. Optical Soc. Am., Vol. 39, May, 1949—pp. 402-405)

The essentials of infrared spectrographic instrumentation and methods are described. The infra-red absorption method was used to obtain a rapid and sufficiently accurate analysis of hydrocarbon mixtures containing from two to twelve components, a maximum of six components being determined in one mixture. An accuracy of ±1% was obtained. The problem of calibration with impure compounds, and a method for its solution were discussed.

Gaylor Technical Survey, Vol. 5, No. 34, September 3, 1949

UNDISCOVERED OIL RESERVES
Anon.—p. 505
("N.Y. Times", August 23, 1949—p. 1)

Levorsen of Stanford University estimates that the world's undiscovered oil reserves are 500 times present annual consumption, but this has been criticized by Hubbert of Shell Oil and Crichton of Johnstown Coal & Coke Co., who believe it is much more.

PATENTS
Anon.—p. 509
("Balto. Eve. Sun.", August 24, 1949—p. 55)

The Canadian Patent Office is now beginning to print its patents. The U.S. Patent Office is publishing abstracts of abandoned applications.

Industrial and Engineering Chemistry, Vol. 41, No. 9, September, 1949

PURIFICATION OF FIVE HYDROCARBONS BY ADSORPTION
Streiff, A. J., Mair, B. J. and Rossini, F. D.—pp. 2037-2038

The paper was presented before the Division of Analytical and Micro Chemistry at the 114th Meeting of the American Chemical Society, St. Louis, Mo. This report describes the purification by adsorption with silica gel of three branched-chain paraffin hydrocarbons, 2, 2, 3-trimethylbutane; 2,2,4-trimethylpentane, and 2,2,4,4,6-pentamethylheptane, and two isomeric alkyl benzenes; 1, 2-diethylbenzene and 1,4-diethylbenzene.

DEHYDRATION OF AQUEOUS METHYL ETHYL KETONE. EQUILIBRIUM DATA FOR EXTRACTIVE DISTILLATION AND SOLVENT EXTRACTION
Newman, M. and Hayworth, C. B. & Treybal, R. F.—pp. 2039-2043

The generalizations of Ewell, Harrison, and Berg are shown to be useful in the preliminary selection of solvents for concentrating aqueous methyl ethyl ketone solutions by extractive distillation or solvent extraction. Vapor-liquid equilibria for the binary systems ketone-butyl Cellosolve and butyl Cellosolve-water, as well as the ternary system ketone-water-butyl Cellosolve are presented and correlated. Ternary liquid equilibria are presented for the systems ketone-water-trichloroethylene, — 1,1,2 trichloroethane, and — chlorobenzene. All the solvents are shown to be useful for the suggested processes.

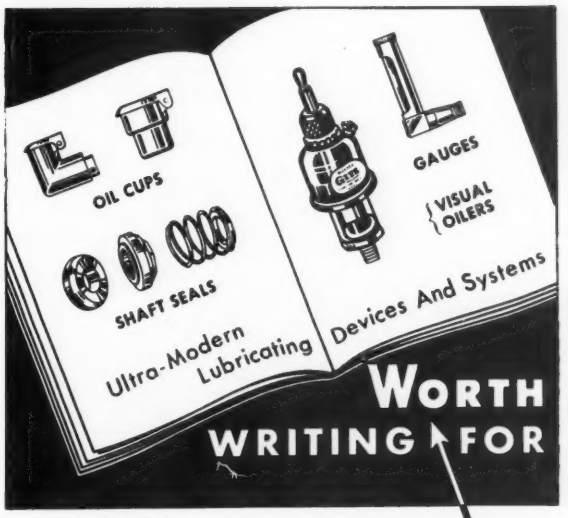
THERMAL CONDUCTIVITY OF LIQUID SILICONES
Bates, O. K.—pp. 1966-1968

The thermal conductivity and coefficient of thermal conductivity for nine liquid silicones of the homologous series of pure trimethyl end-blocked dimethyl siloxanes were determined experimentally. An empirical equation, relating the thermal conductivity as a function of the viscosity and temperature, is proposed for this series of polymers.

REPRESENTATION OF VISCOSITY - TEMPERATURE CHARACTERISTICS OF LUBRICATING OILS
Ramser, J. H.—pp. 2053-2059

VISCOSITY, TEMPERATURE AND PRESSURE OF LUBRICATING OILS
Sanderson, R. T.—pp. 2059-2061

First paper. On the basis of a general functional relation between viscosity and temperature, it is shown by mathematical reasoning that the viscosity index and the A.S.T.M. slope are not unique measures of the frictional change of viscosity with temperature because the viscosity enters the derived relations as an independent variable. The properties of the average fractional change of viscosity, computed over comparable sections of the viscosity-temperature curve and between constant temperature limits, respectively, are discussed. A measure of viscosity-temperature characteristics, viscosity-temperature rating, is proposed for evaluation of oils under actual operating conditions. Second paper. An exact equivalence between compression at 100°F. and cooling at 1 atmosphere pressure, in their effect on the kinematic viscosity of some pure hydrocarbons in the light lubricating oil range, has found and evaluated quantitatively. Data are not available for thorough evaluation of the applicability to petroleum lubricating oils, but it appears possible to predict at least approximately the effect of pressure on their kinematic viscosity from a knowledge of their viscosity-temperature properties.



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Renewed only 4 bearings in 12 years with Farval

FARVAL solves the problem of lubricating turbines in hydraulic turbo-generator plants, according to reports from station managers.

On one Farval-lubricated turbine, only four bearings were renewed in 12 years. Prior to the installation of centralized lubrication it had been necessary at this plant to replace 6 to 8 bushings every six months, each time the turbine was dewatered.

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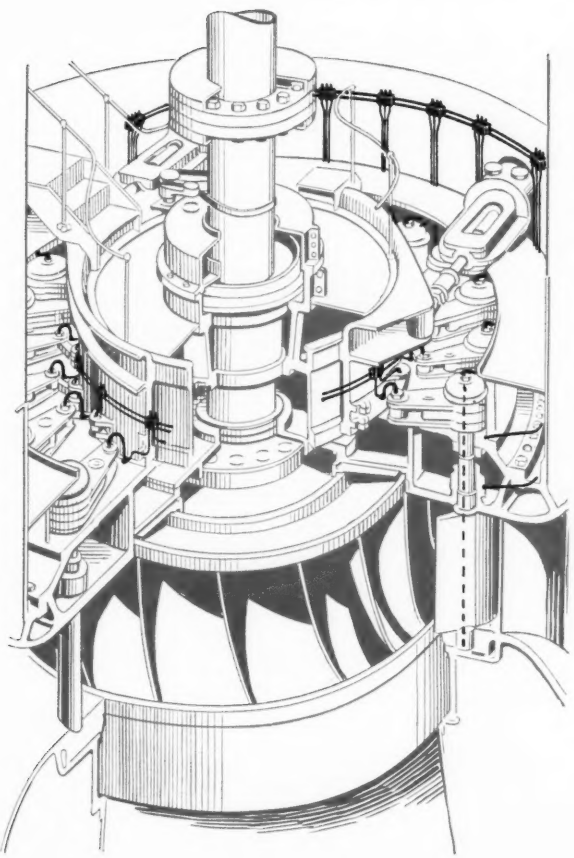

Shutting down a turbo-generator set to replace a worn or damaged bearing is expensive in labor and parts, costly in time and crippling to electric power production. Here as with so many operations throughout industry, Farval lubrication keeps equipment running efficiently, eliminating downtime and safeguarding production, not to mention the saving of labor, lubricant and new bearing costs.

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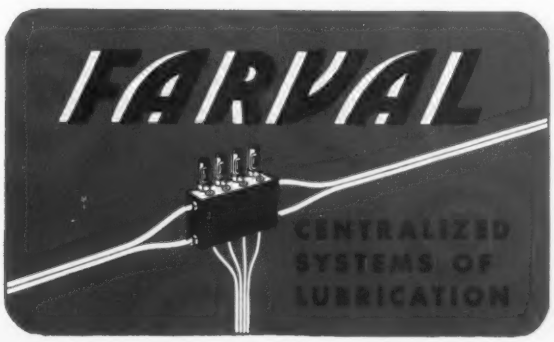

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